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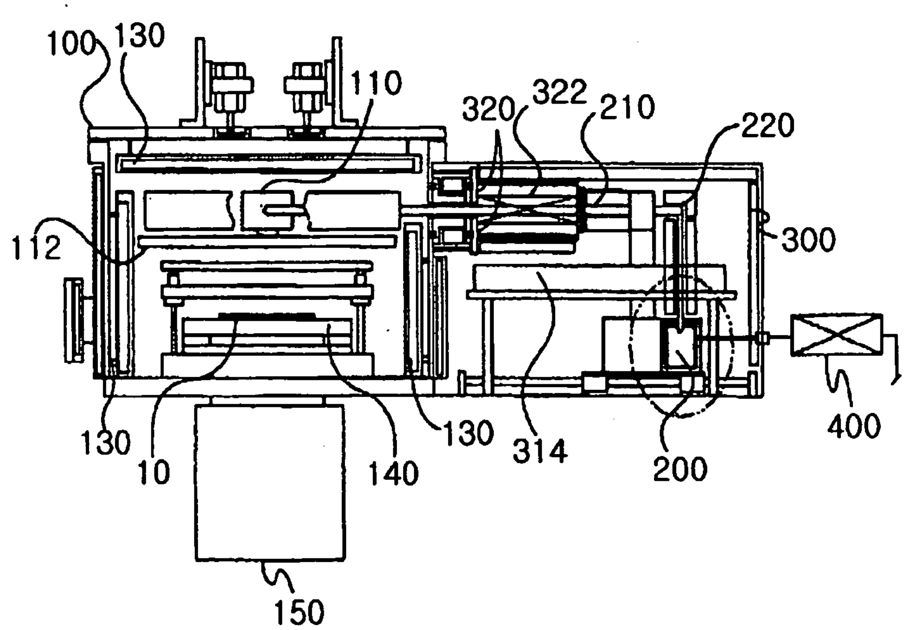

(57) Abstract: The present invention relates to a vapor organic material deposition method and a vapor organic material deposition apparatus using the same which are capable of fast growing a thin film uniformly on a wider substrate by spraying a vapor organic material in a gravity direction using a spraying unit installed in an upper side of the same and accurately and stably adjusting a thickness of a wider substrate of an organic thin film by using a diluting gas as a deposition material and continuously carrying a small size heat source to a scan head.

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APPARATUS AND METHOD FOR DEPOSITING ORGANIC MATTER OF VAPOR PHASE

TECHNICAL FIELD

The present invention relates to a vapor organic material deposition method and a vapor organic material deposition apparatus in a fabrication apparatus of a semiconductor apparatus and a fabrication method of the same, and in particular to a vapor organic material deposition method and a vapor organic material deposition apparatus using the same which are capable of fast growing a thin film uniformly on a wider substrate by spraying a vapor organic material in a gravity direction using a spraying unit installed in an upper side of the same and accurately and stably adjusting a thickness of a wider substrate of an organic thin film by using a diluting gas as a deposition material and continuously carrying a small size heat source to a scan head.

BACKGROUND ART

Recently, a thin film formation technology by a functional high molecular compound as an organic compound and an organic metallic compound is concentrated on a conductive material, photoelectron material, electro-luminescence device material, etc. including an insulation layer material of a semiconductor memory.

A vacuum deposition method used one of a representative technology among the so far developed organic thin film formation methods is implemented in such a manner that a heat evaporation source is installed in a lower portion of a vacuum chamber, and a film growing substrate is installed thereon for thereby forming a thin film. The schematic construction of an organic thin film formation apparatus using a vacuum deposition method will be described. There is provided a vacuum ventilation unit connected with a vacuum chamber. Therefore, a certain vacuum state is maintained in the vacuum chamber using the vacuum ventilation unit. An organic material which is an organic thin film material is evaporated from a heat evaporation source of more than at least one organic thin film material disposed in a lower portion of a vacuum chamber. A heat evaporation source of an organic thin film material is a cylindrical or rectangular parallelepiped container. A film grown organic material is provided in the container. There are quartz, ceramic, etc. as a container material. A heating heater is wound on a surrounding surface of a container unit in a certain pattern. When a certain power is applied, the temperature of a surrounding portion of a container is increased and at the same time the container is heated. When a certain temperature is reached, an organic is evaporated. At this time, the temperature is measured by a temperature adjusting heat conducting unit installed in a lower portion or in an upper portion of the container. Therefore, it is possible to maintain an

organic evaporation material to have a constant temperature for thereby obtaining a desired evaporation rate. The evaporated organic material is carried to a substrate formed of a glass or wafer material disposed far from an upper side of a container by a certain distance. The thusly carried organic material is hardened on the substrate through an absorption, deposition, re-evaporation processes for thereby forming a thin film.

Here, in the organic compound of an organic thin film material, since a vapor pressure is high, and a pyrolysis temperature by a heat is close to an evaporation temperature, it is difficult to control an organic evaporation rate stably for a long time, so that it is impossible to implement a high rate thin film deposition. An organic thin film material evaporated from a heat evaporation source in the vacuum chamber has a certain orientation corresponding to a shape of a crucible hole of an upper portion of a heat evaporation source container and is limited to a limited range and reaches at a substrate, so that it is impossible to obtain a uniform organic thin film formed on a wide area substrate. In addition, a film is grown while a substrate is rotated at a certain rate using a correction unit of a certain orientation for implementing a uniform thin film formation of an organic thin film, so that a rotation radius is increased, and a deposition apparatus is made larger. In addition, since an organic thin film is formed in an unnecessary effective area of a vacuum apparatus, an efficiency of use of an expensive organic material is decreased for thereby

decreasing a productivity.

As described above, when a product is fabricated in application with an electro-luminescence device and functional thin film using an organic thin film in a vacuum deposition method, there are problems such as a lower film growing rate, a lower organic material use efficiency, a non-uniformity of an organic thin film, a difficulty for finely adjusting a mixing amount of a host material and a dopant material, and a difficulty for forming a uniform organic thin film based on a larger substrate. As an example of the above problems, the conventional vacuum deposition apparatus will be described with reference to Figure 1.

Figure 1 is a view illustrating an example of a conventional vacuum deposition apparatus.

As shown therein, in a conventional vacuum deposition apparatus, a certain material deposited on a molybdenum boat 6 is prepared by a certain amount, and an inner pressure of a vacuum chamber 1 is decreased to 10-6torr. In the case that a deposition material is metal, the metal is increased near a melting point using a temperature adjusting apparatus, and the temperature is finely adjusted and is increased until the material is evaporated. At this time, the material on the molybdenum boat 6 starts to evaporate, a previously engaged shutter 5 is opened, and an evaporated material molecular is deposited on the substrate. At this time, a shutter 5 is adapted to prevent an impurity remaining before the material

on the molybdenum boat 6 is evaporated from being deposited on the substrate.

In the thusly constituted vacuum deposition apparatus, it is not easy to predict an accurate amount of the depositing material. Therefore, a large amount of the material must be prepared on the molybdenum boat 6. In addition, since it is impossible to induce vapor in a desired direction, in the case that the above deposition processes are repeatedly performed, the interior of the chamber may be polluted. Therefore, in this case, the interior of the same should be cleaned for thereby causing an inconvenience. Furthermore, the amount of the material prepared on the molybdenum boat 6, the opening and closing time of the shutter 4, and the evaporating time by the temperature adjustment are variables of the thickness adjustment. It is impossible to finely adjust the above variables.

In addition, in the organic semiconductor fabrication method, there are a method for using a unit deposition source, and an OVPD(Organic Vapor Phase Deposition) method proposed by Max Shtein, et. al. in Princeton university.

In the organic semiconductor fabrication method which uses a unit deposition source tank, it takes a long time for depositing each layer used in the organic semiconductor. The amount of the use of the material used for the deposition of each layer is larger. In addition, there is a problem that a density of a deposited film and an adhesive force with respect the

substrate are bad. A fabrication yield for a mass production of an organic semiconductor is decreased. There is a limit in a fabrication process of a wider area substrate for a mass production. Namely, the limit size of the area of the substrate is 370x470mm.

The OVPD method is directed to a method for fabricating each layer used for an organic semiconductor using a carry gas for a vapor organic material in an Axitron method proposed by Max Shtein, et. al. This method is capable of more increasing an efficiency in use of an organic material compared to a method adapted to use a unit deposition source. In addition, it is possible to theoretically fabricate an organic semiconductor of a wider area substrate. However, the method of Axitron which uses the OVPD method uses a scan head of a conventional CVD method. In addition, the substrate of 200x200mm is tested. In this case, a problem of an organic thin film which is weak to heat may occur.

In addition, in order to fabricate for a wider area substrate, a shower head of over 370x470mm must be prepared. However, in this case, there is a problem in constructing the same. In the deposition method of Axitron method, the high temperature heat sources of the deposition source tank 714 and the scan head are fixed. In addition, in a doping in a fabrication of an organic semiconductor, a separate temperature adjustment is implemented by providing more than st least two scan heads in the interior of the system. However, in the OVPD method, since one

scan head is used, if the doping is performed using more than at least two doping materials which have different thermal properties, the material may be changed to a material having a bad thermal property. Namely, in the conventional two methods, the organic semiconductor material is not well deposited on a substrate of a wider area.

DISCLOSURE OF INVENTION

Accordingly, it is an object of the present invention to provide a vapor organic material deposition method and a vapor organic material deposition apparatus using the same which are capable of overcoming the problems encountered in the conventional art.

It is an object of the present invention to provide a vapor organic material deposition method of a wider area substrate and a vapor organic material deposition apparatus using the same which are capable of increasing an adhesive force with respect to a substrate of an organic thin film and accurately and stable adjusting a thickness by diluting an organic material particle in the interior of a deposition source tank in order for an organic semiconductor material to be deposited on a substrate and preventing a temperature increase on a wider area substrate by a heat source of a scan head and in the interior of a deposition chamber using a gate valve of a buffer chamber and a deposition chamber.

To achieve the above objects, there is provided a vapor organic material deposition apparatus which includes a deposition chamber which has an inner space separated from the outside, a mother material mounting portion formed in a bottom surface of the inner space for mounting a mother material therein on which a vapor organic material is deposited, a spraying unit which is positioned in an upper portion of the mother material mounting portion and is adapted to spray a vapor organic material in a direction of the mother material mounting portion, and more than at least one warm keeping heater which radiates a heat to an upper wall surface and side wall surface, more than at least one organic material chamber which more than at least one carry gas inlet hole formed in a hole shape through which a carry gas carrying a vapor organic material is flown in, more than at least one vapor organic material outlet hole formed in a hole shape through which an organic material vapor and carry gas are discharged, a furnace which is formed of a heat-resisting material and has an inner space for storing an organic material, and an organic material heating heater which surrounds an outer surrounding portion of the furnace and heats an inner portion of the furnace to a temperature at which an organic material is evaporated, a flow amount controller which is connected with the carry gas inlet hole and controls the amount and flowing rate of the carry gas flown into the interior of the organic material chamber, a vapor organic material carry pipe which is formed to pass

through the deposition chamber and the organic material chamber and are formed in a pipe shape, so that a vapor organic material in the organic material chamber is carried to a spraying unit, and a vacuum pump which is adapted to decrease an inner pressure of the deposition chamber.

To achieve the above objects, there is provided a vapor organic material deposition method which includes a first step in which a heating heater contacting with an outer surface of an organic material chamber including an organic material therein radiates heat and heats the organic material to a temperature above an evaporation temperature, a second step in which a vapor organic material evaporated by the heating heater is moved to a spraying unit of the deposition chamber in which a mother material on which a vapor organic material is deposited is positioned, through a vapor organic material carry pipe surrounded by a fixed temperature heater which radiates heat, and a third step in which a vapor organic material carried to the spraying unit is sprayed in a gravity direction from an upper portion of the mother material placed in an upper portion of a mother material mounting portion, and is deposited on an upper surface of the mother material.

To achieve the above objects, in a vapor organic material deposition apparatus, there is provided a vapor organic material deposition apparatus of a wider area substrate which includes a gas heater which is adapted to heat an inert gas by adjusting a gas reservoir

having an inert gas therein and a MFC(Mass Flow Controller), a heater pipe wound on an outer portion of a connection pipe for maintaining a temperature, at least one deposition source tank which stores a gas to be deposited and an organic material and heats a high temperature gas and organic material particle by a gas heater in a state that the same are diluted for thereby generating a diluted organic material in a gaseous state, a scan head and buffer chamber which have a deposition rate adjusting unit adapted to check and adjust a movement of the diluted organic material particle, a gate valve which is adapted to implement a gating operation for thereby opening and closing a flow of the diluted organic material particle, and a deposition chamber which is adapted to deposit the diluted particle flown in from the deposition source tank on a wider area substrate, wherein the gas heater heats a gas in order for the deposition source tank adjusts the amount of gas and flows a heat source into the same, and the gate valve is installed between the buffer chamber and the deposition chamber for thereby preventing a temperature increase in a wider area substrate by a heat source of the scan head and in the interior of the deposition chamber.

To achieve the above objects, in a vapor organic material deposition method there is provided a vapor organic material deposition method of a wider area substrate which includes a first step in which an inert gas which flows from a deposition source tank based on an

adjustment of a gas reservoir which stores an inert gas therein and a MFC(Mass Flow Controller) is heated using a gas heater based on an adjustment of a gas mount, and heat source is inputted into the interior, a step in which a temperature is maintained by a heater pipe wound on an outer portion of a connection pipe, a step in which at least one deposition source tank in which a gas to be deposited and an organic material are stored is heated by a gas heater in a state that a high temperature gas and an organic material particle are diluted, and a diluted organic material is obtained in a gaseous state, a step in which a flow of the diluted organic material particle is checked and adjusted, and a gating operation is performed with respect to a scan head and buffer chamber attached with a deposition rate adjusting unit and for opening and closing a flow of a diluted organic material particle, a step in which a diluted particle flown in from the gate valve and the deposition source tank is deposited on a wider area substrate in the deposition chamber, a step in which the gate valve is installed between the buffer chamber and the deposition chamber and a temperature increase is prevented in a wider area substrate by a head source of the scan head and in the interior of a deposition chamber, and a step in which an organic material which is separated when the scan head is moved in the buffer chamber is collected by an assistant furnace installed for a re-circulation of the organic material.

To achieve the above objects, in a fabrication method of an

organic semiconductor apparatus, there is provided a vapor organic material deposition method of a wider area substrate which includes a step(S710) in which a substrate is loaded into a deposition chamber in a deposition apparatus, a step(S712) in which a deposition source tank is pre-heated and a high temperature gas is flown in at a temperature of 200°C – 600°C, a step(S714) in which a high temperature gas and an organic material particle are mixed in the interior of the deposition source tank for thereby forming a mixture, and is heated for thereby generating a SGHP(Solid-Gas Heterogeneous Phase) material, a step(S716) in which a large amount of vapor organic material SGHP are carried from the deposition source tank to the buffer chamber through the connection pipe, a step(S718) in which the flowing amount of the vapor organic material is measured using a vapor organic material sensor in the buffer chamber, and when the flowing amount of the vapor organic material reaches at a certain set amount, the buffer gate valve is opened, a step(S720) in which a vapor organic material is deposited based on a scan head operation, a step(S722) in which after a set deposition time is passes, the scan head is moved, and a step(S724) in which the buffer gate valve is closed, and the substrate is unloaded.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and

the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which like reference numerals denote like parts, and in which:

Figure 1 is a view illustrating an example of a conventional vacuum deposition apparatus;

Figure 2A is a plan view illustrating a vapor organic material deposition apparatus according to the present invention;

Figure 2B is a cross sectional view taken along line A-A of Figure 2A;

Figure 2C is a plan view taken along line B-B of Figure 2A;

Figure 2D is a view illustrating an organic material chamber of a portion C of Figure 2B;

Figure 3A is a cross sectional view illustrating a state that a spraying unit is moved and sprays a vapor organic material according to the present invention;

Figure 3B is a cross sectional view illustrating a state that a mother material mounting unit having a mother material thereon is moved in a horizontal direction based on a carrying method using an electric magnet when a spraying unit sprays a vapor organic material according to the present invention;

Figure 3C is a cross sectional view illustrating a state that a mother material is deposited on a mother material using a spraying tube according

to the present invention;

Figure 3D is a cross sectional view illustrating a state that a vapor organic material is deposited on a mother material as a spraying tube is rotated and moved upwardly and downwardly according to the present invention;

Figure 4A is a cross sectional view illustrating a state that a vapor organic material and a carry gas are mixed in the interior of a furnace according to the present invention;

Figure 4B is a cross sectional view illustrating a state that a vapor organic material and a carry gas are mixed in the outside of a furnace according to the present invention;

Figure 5A is a cross sectional view illustrating a rectangular parallelepiped furnace which has a vapor organic material discharging hole in an upper end portion according to the present invention;

Figure 5B is a cross sectional view illustrating a rectangular parallelepiped furnace which has a plurality of vapor organic material discharging holes in an upper end portion according to the present invention;

Figure 5C is a cross sectional view illustrating a cylindrical furnace which has a vapor organic material discharging hole in an upper end portion according to the present invention;

Figure 5D is a cross sectional view illustrating a cylindrical furnace

which has a plurality of vapor organic material discharging holes in an upper end portion according to the present invention;

Figure 6 is a cross sectional view illustrating a fixed temperature heater in an outer portion of a vapor organic material carry pipe according to the present invention;

Figure 7 is a cross sectional view illustrating a vapor organic material deposition apparatus of a wider area substrate according to the present invention;

Figure 8 is a cross sectional view illustrating a plurality of deposition source tanks and scan heads according to the present invention;

Figure 9 is a view for explaining an operation method of a scan head in the interior of a deposition chamber, which is capable of carrying a SGHP organic material according to the present invention;

Figure 10 is a view for explaining a moving method of a scan head capable of carrying a SGHP organic material in the interior of a system of Figure 8 according to the present invention;

Figure 11 is a view for explaining a vapor organic material generation method of an organic semiconductor apparatus according to the present invention;

Figure 12 is a view for explaining a deposition method in the interior of a deposition chamber based on a vapor organic material generated based on the method of Figure 11 according to the present invention;

Figure 13 is a floe chart of an operation of a deposition apparatus according to the present invention;

Figure 14 is a relative relationship graph of a temperature of a gas diluted and a deposition amount according to the present invention;

Figure 15 is a graph of a vapor organic material with respect to the amount of a diluting gas according to the present invention; and

Figure 16 is a graph of a relationship of a deposition source tank temperature and a deposition amount in the case that only a deposition source tank is heated without a diluting gas according to the present invention.

< Description of reference numerals of major elements of the drawings >

10: mother material	20: organic material
100: deposition chamber	110: spraying unit
112: guide plate	120: guide rail
122: guide rail support plate	130: warm keeping heater
140: mother material mounting.unit	150: vacuum pump
200: organic material chamber	210: vapor organic material carry pipe
220: furnace	230:.organic material heater
240: carry gas inlet pipe	300: assistant chamber
310: moving shaft	312: moving block
314: carry unit	320: sealing flange

322: bellows	700: deposition chamber
701: gas reservoir	702: MFC(Mass Flow Controller)
703: gas heater	706:heater pipe
707: connection pipe	709: scan head
710: buffer chamber	711: gate valve
712: substrate	713: deposition chamber
714: deposition source tank	715: deposition rate adjusting unit

BEST MODE FOR CARRYING OUT THE INVENTION

<First embodiment>

Figure 2A is a plan view illustrating a vapor organic material deposition apparatus according to the present invention.

The vapor organic material deposition apparatus according to the present invention includes a deposition chamber according to a first embodiment of the present invention, an organic material chamber for heating an organic material and changing to a vapor state, and an assistant chamber which includes a driving apparatus for driving an operation of a spraying unit which sprays a vapor organic material and an organic material chamber.

A deposition chamber 100 according to a first embodiment of the present invention includes an inner space which is separated from an

outside and has a structure so that a mother material 10 on which a vapor organic material is deposited , is mounted in a bottom surface of the inner space. In addition, the deposition chamber 100 includes a spraying unit 110 which is positioned in an upper portion of the mother material 10 and is adapted to spray a vapor organic material to an upper surface of the mother material 10, a guide rail 120 which is engaged with the spraying unit 110 and is longitudinally extended to be slidably engaged with a guide plate(not shown) adapted to guide a sliding movement of the spraying unit 110, a guide rail support plate 122 which is adapted to fixedly support the guide rail 120, and more than at least one warm keeping heater 130 adapted to maintain the temperature of the interior of the deposition chamber 100 at a certain degree by radiating heat to the outside.

The organic chamber 200 is constructed in such a manner that an organic material is evaporated by applying heat to an organic material stored in the interior and is formed in a pipe shape and is connected with a vapor organic material carry pipe 210 connected with the spraying unit 110 through the deposition chamber 100 for thereby carrying a vapor organic material to the spraying unit 110.

The assistant chamber 300 includes a moving shaft 130 which is engaged with the spraying unit 110 in a direction parallel with the guide rail 120 through the deposition chamber 100 in order for the spraying unit 100 is moved along the guide rail 120, a moving block 312 which is engaged

with the moving shaft 130 and is moved in a direction parallel with the guide rail 120 based on an engagement with the carry unit 314, and a sealing flange 320, a bellows 322 and an organic material chamber 200 which are positioned in a portion in which the vapor organic material carry pipe 210 and the moving shaft 130 pass through the deposition chamber 100 and are directed to buffering a vacuum difference between a high vacuum state of the deposition chamber and a low vacuum chamber or standby state of an assistant chamber 300 and to separating the same for thereby connecting above two chambers.

Figure 2B is a cross sectional view taken along line A-A of Figure 2A according to the present invention.

As shown therein, a warm keeping heater 130 is installed in the interior of the deposition chamber 100 for constantly maintaining an inner temperature of the deposition chamber 100 in an upper and side surface therein. A mother material mounting portion 140 is provided in the bottom surface of the deposition chamber 100 for mounting the mother material 10 on which an organic material is deposited. A spraying unit 110 is provided in an upper portion of the mother material mounting unit 140 for spraying a vapor organic material. In addition, a vacuum pump 150 is provided in a lower outer surface of the deposition chamber 100 for making the interior of the deposition chamber 100 a high vacuum state.

An organic material chamber 200 is provided in an inner lower

portion of the assistant chamber 300 for evaporating an organic material. A vapor organic material carry pipe 210 is connected to an upper portion of the organic material chamber 200 for carrying a vapor organic material from the organic material chamber 200 to the spraying unit 110. A carry unit 314 is provided between the organic material chamber 200 and the vapor organic material carry pipe 210 for controlling the movement of the spraying unit 110. In addition, the assistant chamber 300 is adapted to input an inert gas into the interior of the organic material chamber 200, and a flow amount controller is provided in the outer portion of the same for thereby controlling the amount of the input of the inert gas. The inert gas inputted into the organic material chamber 200 plays a role of a moving medium of the vapor organic material. Therefore, it is possible to finely control the amount of carry of the vapor organic material, and it is possible to uniformly distribute the vapor organic material.

Figure 2C is a cross sectional view taken along line B-B of Figure 2A according to the present invention.

As shown therein, the guide plate 112 engaged with the spraying unit 110 is slidably engaged with the guide rail 120 adapted to guide the moving direction of the spraying unit 110. The mother material mounting unit 140 adapted to mount the mother material 10 therein includes an electric magnet moving apparatus using an electric magnet 142 for thereby implementing a fine movement in the horizontal direction.

The electric magnet moving apparatus adapted to the mother material mounting unit 140 may be implemented based on the technology of the patent "A deposition apparatus for fabricating an electro-luminance device using an electric magnet and a deposition method using the same(Patent application No. 10-2001-0077739). The same is not limited thereby. In addition, a conventional moving apparatus may be adapted instead of using the electric magnet moving apparatus.

It is possible to more accurately arrange the positions of the spraying unit 110 and the mother material 10 in such a manner that the position of the spraying unit 110 is adjusted based on the guide rail 120, and the position of the mother material mounting unit 140 is adjusted using an electric magnet moving apparatus, so that it is possible to implement an accurate and effective organic material spraying operation thereby.

Figure 2D is a view illustrating an organic material chamber of the portion C of Figure 2B according to the present invention.

The organic material chamber 200 is formed of a heat-resisting material in a sealed shape having an inner space for storing an organic material therein and includes a furnace 220 which has a carry gas inlet hole 222 formed in a hole shape in order for a carry gas adapted to carry a vapor organic material to be flown in and a vapor organic material inlet hole 224 formed in a hole shape in order for an organic material vapor and carry gas to be flown out, and an organic material heating heater 230

which surrounds an outer portion of the furnace 220 and is adapted to heat the interior of the organic material chamber to a temperature at which the organic material is evaporated.

The inlet pipe 240 which is formed in a pipe shape and is connected with a flow amount controller 400 of Figure 2B is connected with the carry gas inlet hole 222 formed in the furnace 220 through the organic material chamber 200, so that an inert gas inputted from the flow amount controller 400 is flown into the interior of the furnace 220.

In addition, the vapor organic material carry pipe 210 which is formed in a pipe shape and is connected with the spraying unit 110 of Figure 2B is connected with the carry gas outlet hole 224 formed in the furnace 220 through the organic material chamber 200, so that the organic material which is heated and evaporated by the organic material heating heater 230 is carried to the spraying unit 110 adapted to spray a vapor organic material to the mother material.

Figure 3 is a view illustrating various operation types of a vapor organic material deposition apparatus according to the present invention.

Figure 3A is a view illustrating a state that a spraying unit of a shower head shape is moved and sprays a vapor organic material according to the present invention.

The spraying unit adapted to spray a vapor organic material 22 may be fabricated to have various shapes of a spraying port through which

the vapor organic material 22 is sprayed for thereby uniformly spraying the vapor organic material 22. Figure 3A is a view illustrating a state that a deposition operation is performed using a shower head shaped spraying unit having a plurality of spraying ports(not shown) each having a smaller diameter.

In the case that the spraying unit is fixed to a certain position for thereby spraying a vapor organic material, there is a problem that the vapor organic material is not uniformly sprayed onto the mother material. As shown in Figure 3A, the spraying unit 110 adapted to spray the vapor organic material 22 to the upper surface of the mother material 10 is horizontally moved along the guide rail and sprays the vapor organic material 22, so that the vapor organic material 22 is uniformly deposited on the entire surfaces of the mother material 10. At this time, in the case that the vapor organic material 22 deposited on the mother material 10 is more than at least two kinds, there is provided a mixing tank 250 in the vapor organic material carry pipe 210 for uniformly mixing the different kinds of the vapor organic materials before the vapor organic material is carried to the spraying unit 110. In addition, the mixing tank 250 includes more than at least one partition in the interior of the same for uniformly mixing more than at least two vapor organic materials while the same is flown into the interior of the mixing tank 250 and is flown to the outside of the mixing tank 250.

Figure 3B is a view illustrating a state that a mother material mounting unit with a mother material is horizontally moved based on a carrying method using an electric magnet when a spraying unit which is formed in a shower head shape sprays a vapor spraying material.

On the contrary to the operation that the spraying unit 110 is horizontally moved when the spraying unit 110 sprays a vapor organic material 22 as shown in Figure 2A, when the mother material mounting unit 140 with the mother material 10 is horizontally moved when the spraying unit 110 sprays a vapor organic material 22 as shown in Figure 3B, it is possible to obtain the same effect as the effect of Figure 2A in which the vapor organic material 22 is uniformly deposited on the upper surface of the mother material 10. In addition, differently from the operation that the spraying unit 110 is moved by the guide rail as shown in Figure 3A, the method in which the mother material mounting unit 140 is horizontally moved when the spraying unit 110 sprays a vapor organic material 22 uses a carrying method using an electric magnet, so that it is possible to accurately control the movement of the mother material mounting unit 140.

Figure 3C is a view illustrating a state that a vapor organic material is deposited on a mother material using a spraying tube according to the present invention.

As shown therein, in a deposition apparatus using a spraying tube,

a vapor organic material 22 which is carried into the interior of the deposition chamber 100 through a mixing tank 250 adapted to uniformly mix more than at least two vapor organic materials is formed of quartz, ceramic or metallic material and is formed in a structure in such a manner that the thusly formed organic materials are deposited on an upper surface of the mother material 10 through the spraying tube 112 which has a diameter of 3~20mm. The vapor organic material deposition apparatus using the spraying tube 112 is capable of forming a flat organic thin film at a high rate.

Figure 3D is a view illustrating a state that a vapor organic material is deposited on a mother material as the spraying tube is rotated and moved upwardly and downwardly according to the present invention.

As shown in Figure 3C, the deposition apparatus includes a rotation motor 114 installed in an upper portion of the deposition chamber 100 and adapted to rotate the spraying tube 112, and a vertical moving motor 116 adapted to vertically moving the spraying tube 112. In the above construction, the spraying tube 112 is rotated and is moved upwardly and downwardly and at the same time sprays a vapor organic material 22 on an upper surface of the mother material 10. In addition, the spraying tube 112 may have a step shaped bent portion in such a manner that an end portion of the spraying tube 112 through which a vapor organic material 22 is sprayed, moves in a circular shape when the same is rotated by the

rotation motor 114.

In this embodiment, since it is possible to freely adjust the position of the spraying tube 112 by the rotation motor 114 and the vertical moving motor 116, the deposition apparatus of Figure 3C is possible to uniformly spraying a vapor organic material.

Figure 4 is a view illustrating a process that a carry gas is mixed with a vapor organic material which is obtained by heating an organic material.

Figure 4A is a view illustrating a state that a vapor organic material and a carry gas are mixed in the interior of a furnace according to the present invention.

As shown in Figure 4A, the organic material 20 heated and evaporated by the organic material heating heater 230 is mixed with a carry gas flown in along the inlet pipe 240 connected with the interior of the furnace 220 in the interior of the furnace 220. When the vapor organic material and the carry as are mixed in a such a manner of Figure 4a, since the organic material is evaporated and at the same time is mixed with a carry gas, it is possible to implement an easier mixing and uniform mixing operation.

Figure 4B is a view illustrating a state that a vapor organic material and a carry gas are mixed in the outside of a furnace according to the present invention.

As shown therein, the mixing apparatus is constituted in such a manner that a carry gas inlet pipe 240 is connected with a vapor organic material carry pipe 210 positioned in the outside of the vapor organic material chamber 200. The vapor organic material 20 which is heated and evaporated by the vapor organic material heating heater 230 is carried along the vapor organic material carry pipe 210 and is mixed with a carry gas flown in through the carry gas inlet pipe 240 connected with the vapor organic material carry pipe 210. Since the thusly constituted mixing apparatus does not have an additional structure for engaging the carry gas inlet pipe 240 to the furnace 220 and the organic material chamber 200, it is possible to implement an easier fabrication of the system.

Figure 5 is a view illustrating various constructions of a furnace and a vapor organic material outlet hole according to the present invention.

Figure 5A is a view illustrating the construction of a furnace which is formed in a rectangular parallelepiped shape and has one vapor organic material outlet hole in an upper portion of the same according to the present invention.

As shown therein, the outer surfaces of the rectangular parallelepiped shape furnace 220 are surrounded by the organic material heating heater 230 adapted to heat the organic material in the interior of the furnace 220, and a vapor organic material outlet hole 222 is provided in an upper portion of the same for thereby discharging a vapor organic

material.

Figure 5B is a view illustrating the construction of a furnace which is formed in a rectangular parallelepiped shape and has a plurality of vapor organic material outlet holes in an upper portion of the same.

A large amount of the vapor organic material must be discharged for a high rate film growth in which a vapor organic material is deposited on a mother material at a high rate. Namely, there is a problem that it is impossible to discharge a large amount of vapor organic material by providing only one vapor organic material outlet hole 222 in the upper portion of the furnace 220. In order to overcome the above problem, as shown in Figure 5B, there are provided a plurality of vapor organic material outlet holes 222 in an upper portion of the furnace 220.

Figure 5C is a view illustrating the construction of a furnace which is formed in a cylindrical shape and has one vapor organic material outlet hole in an upper portion of the same.

In order to more effectively evaporate the organic material in the interior of the furnace 220, the furnace 220 may be fabricated in various shapes. In the case that the furnace 220 is formed in a rectangular parallelepiped shape, since the heat generated in the organic material heating heater 230 surrounding the furnace 220 is not uniformly transferred to the outer surfaces of the furnace 220, a lot of heat loss occurs. Therefore, it is impossible to accurately adjust the amount of the

vapor organic material generated. As shown in Figure 5C, the furnace 220 is formed in a cylindrical shape, so that the heat generated in the organic material heating heater 230 is uniformly transferred to the outer surfaces of the furnace 220. Therefore, it is possible to effectively use the heat generated in the organic material heating heater 230 by changing the construction of the furnace 220 and to easily adjust the amount of the generation of the vapor organic material. In addition, the furnace 220 is not limited to the rectangular parallelepiped and cylindrical shapes. Namely, the furnace 220 may be formed in a polygonal hexahedron and spherical shape.

Figure 5D is a view illustrating the construction of the furnace which is formed in a cylindrical shape and has a plurality of vapor organic material outlet holes in an upper portion of the same.

In order to discharge a large amount of the vapor organic material from the cylindrical furnace 220 as shown in Figure 5C, there may be provided a plurality of vapor organic material outlet holes in the upper surface of the furnace 220 in the same manner as Figure 5B.

Figure 6 is a view illustrating the construction that a fixed temperature heater is provided in the outside of the vapor organic material carry pipe according to the present invention.

When the vapor organic material from the furnace 220 is carried through the vapor organic material carry pipe 210, when the vapor organic

material carry pipe 210 is contacted with an external air and is cooled, the vapor organic material flowing in the interior of the vapor organic material carry pipe 210 is also cooled. In this case, when the vapor organic material is cooled to a certain temperature below a proper temperature, the deposition on the mother material becomes bad. As shown in Figure 6, in order to overcome the above problem, a fixed temperature heater 260 having a heating wire 262 adapted to generate heat and accurately maintain and adjust the heating temperature is provided in the outer portion of the vapor organic material carry pipe 210.

In addition, the fixed temperature heater 260 may be provided in the organic material chamber 220 for thereby constantly maintaining the temperature of the organic material chamber 200.

<Second embodiment>

A fabrication apparatus of an organic semiconductor apparatus and a fabrication method of the same which may use a wider area substrate used when an organic semiconductor is fabricated according to a second embodiment of the present invention will be described with reference to Figure 7.

In the organic semiconductor system of Figure 7, the vapor organic material deposition apparatus 700 of the wider area substrate of the second embodiment of the present invention includes a gas reservoir

701 adapted to reserve an inert gas therein, a gas heater 703 which is installed between the gas reservoir 701 and a MFC(Mass Flow Controller) 702 and is adapted to heat the inert gas, a connection pipe 707 installed in the interior of the heater pipe 706, at least one deposition source tank 714, a deposition source tank 714 which includes a gas deposited and an organic material therein, a scan head 709 which has a deposition rate adjusting unit 715 for checking and adjusting the flow of the deposition gas, a buffer chamber 711, a gate valve 711 adapted to gate the flow of the deposition gas and open and close the same, and a deposition chamber 713 adapted to deposit a gas flown in from at least one deposition source tank 714 on a wider area substrate 712.

As shown in Figure 7, the gas reservoir 701 may store an inert gas such s Ar, He, N2, etc. and oxygen and all kinds of gases used in a conventional CVD and which is not explosive. The amount of the gas is adjusted, and the gas is flown into the interior of the heat deposition source tank 714 through the MFC 702. The thusly flown-in gas is heated to a high temperature of 200~600°C using the gas heater 703 and is flown into the interior of the heat source.

In the present invention, a state that an organic material particle and a high temperature gas co-exist, namely, a non-uniform state of a solid and gas is assumed as a solid-gas heterogeneous phase(SGHP), and a material of a diluted state is assumed as a material of the SGHP. In

addition, the organic material in the interior of the deposition source tank 714, for example, the organic material is diluted with a certain material such as Alq3 and exists in the interior of the deposition source tank 714. The material of the inert SGHP is heated by a heat source in the deposition source tank 714, and the SGHP in the interior of the deposition source tank 714 is heated by a convention current effect for thereby generating a large amount of the organic material gas phase. In addition, the SGHP material of the organic semiconductor is inputted into the interior of the deposition chamber 713 using a pressure difference between the deposition chamber 713 and the deposition source tank 714 through a connection pipe 707 of the organic semiconductor deposition chamber 713. In the above process, the connection pipe 707 is heated to a high temperature for preventing the vapor organic material from being accumulated in the interior of the connection pipe 707. In particular, when using Alq3, it is preferably heated to 320°C. In the above heating process, in order to prevent a heat loss of the connection pipe 707, a double pipe is formed for thereby constantly maintaining the temperature gradient. In addition, the vacuum state is maintained in the connection pipe 707 for thereby maintaining a temperature of the connection pipe 707. In addition, in the downward type method, since the shadow effect by the mask may be eliminated by adapting the deposition source tank capable of storing a large amount of materials, the thick shadow mask may be used. Namely, it

is possible to implement a long time process by decreasing the alignment error of the aligning portions of the shadow mask.

The vapor organic material inputted into the scan head 709 through the connection pipe 707 is deposited on the upper portion of the substrate 712. At this time, the inner portions of the scan head 709 are heated using a resistance type heat source based on the same method as the connection pipe 707 for preventing a vapor organic material deposition. In addition, in the case that the deposition process is not performed in the substrate in the scan head 709, the scan head 709 is moved to the buffer chamber 710. In addition, the buffer chamber 710 and the deposition chamber 713 are fully separated, so that a temperature increase is prevented in the substrate in which the heat source of the scan head 709 is wider and in the interior of the deposition chamber 713.

When the scan head 709 is positioned in the buffer chamber 710, the amount of the vapor organic material sprayed from the scan head 709 is adjusted and stabilized using a crystal sensor 715 of the monitor in the interior of the buffer chamber 710. Actually, a thickness measuring system does not exist in the interior of the deposition chamber. The adjustment of the thickness in the process is performed based on a process time.

Figure 8 is a view illustrating a plurality of deposition source tanks and scan heads capable of effectively processing a SGHP organic material in the interior of the system of Figure 7.

As shown therein, first, second and third deposition source tanks 741, 742 and 743 supply a large amount of the organic material through the first, second and third connection pipes 771, 772 and 773 connected with the tanks and the first, second and third scan heads 791, 792 and 793. In addition, in the buffer chamber, there is provided an assistant furnace 745 in such a manner that as the scan head is moved, the organic material is collected and re-circulated,.

Figure 9 is a view of an operation method of a scan head in the deposition chamber capable of carrying a SGHP organic material according to the present invention.

As shown therein, in the deposition method using the scan head 709 according to the present invention, the vapor organic material itself is performed based on a laminar flow pumping operation by the HIVAC pump 714 and is moved in the directions indicated by arrows of L, L', L" and L'". Therefore, the deposition is performed based on the opening and closing operation of the gate valve 71. Since the pumping port 732 is provided in a lower portion of the substrate, the flow of the vapor organic material is stably implemented, so that it is possible to implement a uniform thickness of the organic material thin film deposited on a wider area substrate. Therefore, since there is not any loss in the deposition in the directions of arrows of L, L', L" and L'", it is possible to significantly increase the efficiency of the material.

Figure 1-0 is a view of a moving method of a scan head capable of carrying a SGHP organic material of the interior of Figure 8. The movement of the longitudinal direction of the scam head 709 in the deposition process of Figure 10 is implemented in such a manner that the piston rod 718 reciprocates between P through P' at a constant speed using the motor 717. The length of the scan head 719 and the moving length of the longitudinal direction of the scan head 709 using the motor 717 are determined based on the size of the substrate. In addition, the scan head adjusts the amount of the generation of the vapor organic material by a flow rate adjusting unit 716.

Figure 11 is a view for explaining a vapor organic material generation method of an organic semiconductor apparatus according to the present invention.

As shown therein, there are provided a deposition source tank 714, an external heat source heater 701, an organic material particle 752 in a deposition source tank 714, a high temperature gas 753 in the interior of the deposition source tank 714, an organic material stored in the interior of the deposition source tank 714 and a gas inputting pipe 755. In the vapor organic material generation method of a semiconductor apparatus according to the present invention, when a vapor organic material is generated, since the heat conductivity of the materials used in the organic semiconductor are low, when a common cell type heat source is used, an

evaporation of an organic material is difficult, and since a heat is concentrated on a certain portion, the organic materials in the deposition source tank 714 may be deteriorated.

As shown in Figure 11, a high temperature gas is sprayed into the deposition source tank 714 through the gas input pipe 755, and in the organic material itself, the gas and organic material are diluted in the interior of the deposition source tank 714. Therefore, the organic material particle 752 and high temperature gas 753 coexist in the deposition source tank 714. In addition, The temperature of the deposition source tank 714 is increased using the heat source heater 751 in the outer portion of the deposition source tank 714. A heat conduction is performed in the diluting portion of the coexisting state in the heating portion based on a convection current method for thereby generating a large amount of the organic materials. In addition, it is possible to generate a large amount of the vapor organic material at an external temperature of a heat source lower compared to the conventional method.

Figure 12 is a view illustrating a deposition method in the interior of the deposition chamber based on a vapor organic material generated in Figure 11 according to the present invention. The deposition and carrying method of the vapor organic material of Figure 12 will be described. As described above, it is possible to generate a large amount of the vapor organic material in the interior of the deposition source tank 714.

Therefore, a difference between a vacuum pressure in the interior of the deposition chamber 713 and the vacuum pressure of the interior of the deposition source tank 714 is above 100 times. For example, if the vacuum degree of the system is 10-4Torr and the pressure difference is formed in such a manner that the pressure of the deposition source tank 714 is 10-1Torr, it is possible to induce the vapor organic material in the deposition chamber in the interior of the deposition source tank 714. In addition, the connection pipe is heated to a high temperature in order for the vapor organic material not to be deposited. In the deposition chamber of Figure 12, the scanning method including the scan head 761 and the substrate 762 will be described. The vapor organic material induced by the scanning method of Figure 12 is actually deposited on the substrate. However, the vapor organic material is not deposited on a wider area substrate at one time. As shown in Figure 12, the deposition process on a wider area substrate is performed as the deposition is performed on a certain region of the substrate, and the scan head 709 is moved at a constant speed based on the movement of the scan head 709.

Figure 13 is a flow chart of an operation of a deposition apparatus. In the deposition apparatus, the substrate 712 is loaded into the deposition chamber 710(S710). The deposition source tank 714 is pre-heated, and a high temperature gas of 200°C to 600°C is inputted into the deposition source tank 714(S712). In addition, the high temperature of the interior of

the deposition source tank 714 and the organic material particles are mixed for thereby forming a certain mixture. When the temperature of the deposition source tank 714 is increased, a SGHP material is generated(S714). A large amount of the generated SGHP material is carried from the deposition source tank 714 to the buffer chamber 710 through the connection pipe 707(S716). At this time, in the buffer chamber 710, the flow amount of the vapor organic material is measured using a vapor organic material sensor. When the amount of the vapor organic material reached at a set amount, the buffer gate valve is opened(S718). The deposition process of the vapor organic material is performed based on the operation of the scan head 709(S720). After the set deposition time is passed, the scan head 709 is moved(S722), and the buffer gate valve 711 is closed, and the substrate is unloaded(S724).

The vapor organic material deposition apparatus and method of a wider area substrate according to the present invention will be described with respect to the results of the experiments.

According to the experiments using the apparatus of Figure 13, the graphs of Figures 7, 10, 15 and 16 will be described based on the conditions: Used material: Alq_3, substrate size: 370x470mm, used gas: Ar(340°C), deposition source tank temperature: 300°C, uniformity of deposition source tank: ±5%.

Figure 14 is a relative relationship graph of a temperature of a gas

diluted and a deposition amount according to the present invention, Figure 15 is a graph of a vapor organic material with respect to the amount of a diluting gas according to the present invention, and Figure 16 is a graph of a relationship of a deposition source tank temperature and a deposition amount in the case that only a deposition source tank is heated without a diluting gas according to the present invention.

As shown in Figure 14, it is checked that there is not any effect in the temperature of the diluting gas with respect to the amount of the deposition. As shown in Figure 15, as the amount of the diluting gas is increased, the amount of the SGHP in the interior of the deposition source tank 714 is increased, and the amount of the gaseous organic material is increased by the heat of the deposition source tank 714, so that the amount of the vapor organic material produced through the scan head 709 is increased. In addition, as shown in Figure 16, in the case that the deposition source tank 714 itself is heated, it is checked that a small amount of a gaseous organic material is generated.

In other words, as shown in Figures 13, 14, 15 and 16, in the case that there is not a diluting gas, the amount of the SGHP of the interior of the deposition source tank 714 is increased based on the input of the diluting gas compared to the method of the conventional deposition source tank 714 in which the amount of the generation of the vapor organic material is small. In addition, it is checked that the SGHP generates a

large amount of the vapor organic material in the interior of the deposition source tank 714 based on the conventional current principle.

Therefore, since the buffer chamber 710 and the deposition chamber 713 are fully separated using the gate valve 711, it is possible to prevent a temperature increase in the substrate in which the heat source of the scan head 709 is wider, and in the interior of the deposition chamber 713. In addition, the adhesive force with respect to the substrate of the organic thin film is increased, and it is possible to adjust the thickness to a common thickness accurately and stably. It is possible to store a large amount of the materials.

As described above, in the vapor organic material deposition method and a vapor organic material deposition apparatus using the same according to the present invention, it is possible to uniformly deposit a vapor organic material on a wider area substrate and to fast grow a film. In addition, it is possible to implement a fine adjustment of the mixing amount of the organic material. In addition, since a vapor organic material is sprayed on only a portion on which a vapor organic material is deposited, it is possible to effectively deposit a vapor organic material. The organic material may be saved in the present invention.

In addition, in the vapor organic material deposition method and a vapor organic material deposition apparatus using the same according to the present invention, it is possible to increase an adhesive force with

respect to a substrate of an organic thin film by diluting an organic material particle in the interior of the deposition source tank. In addition, it is possible to prevent a temperature increase in a wider area substrate of a heat source by a scan head and in the interior of the deposition chamber by fully separating the buffer chamber and the deposition chamber using a gate valve and continuously moving a heat source of a small side of the scan head. In addition, in the present invention, since it is possible to eliminate a shadow effect by a mask in a downward method by adapting a deposition source tank which is capable of storing a large amount of materials, it is possible to use a thick shadow mask. Namely, it is possible to overcome a problem in an aligning portion of a shadow mask.

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described examples are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the meets and bounds of the claims, or equivalences of such meets and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A vapor organic material deposition apparatus, comprising:

a deposition chamber which has an inner space separated from the outside, a mother material mounting portion formed in a bottom surface of the inner space for mounting a mother material therein on which a vapor organic material is deposited, a spraying unit which is positioned in an upper portion of the mother material mounting portion and is adapted to spray a vapor organic material in a direction of the mother material mounting portion, and more than at least one warm keeping heater which radiates a heat to an upper wall surface and side wall surface;

more than at least one organic material chamber which more than at least one carry gas inlet hole formed in a hole shape through which a carry gas carrying a vapor organic material is flown in, more than at least one vapor organic material outlet hole formed in a hole shape through which an organic material vapor and carry gas are discharged, a furnace which is formed of a heat-resisting material and has an inner space for storing an organic material, and an organic material heating heater which surrounds an outer surrounding portion of the furnace and heats an inner portion of the furnace to a temperature at which an organic material is evaporated;

a flow amount controller which is connected with the carry gas inlt hole and controls the amount and flowing rate of the carry gas flown into

the interior of the organic material chamber;

a vapor organic material carry pipe which is formed to pass through the deposition chamber and the organic material chamber and are formed in a pipe shape, so that a vapor organic material in the organic material chamber is carried to a spraying unit; and

a vacuum pump which is adapted to decrease an inner pressure of the deposition chamber.

2. The apparatus of claim 1, wherein said deposition chamber includes more than at least one guide rail in a longitudinal direction of the vapor organic material carry pipe in a portion in which the spray unit is engaged, and said spraying unit includes a guide plate which is engaged to be slidable with the guide rail in a portion contacting with the guide rail.

3. The apparatus of either claim 1 or claim 2, wherein said deposition chamber includes a rotation motor which rotates the spraying unit, and a moving motor which is adapted to move the spraying unit in an upward and downward direction.

4. The apparatus of claim 1, wherein said vapor organic material carry pipe includes a fixed temperature heater which has a heat wire adapted to generate heat and a fixed temperature heat radiating device

system adapted to accurately maintain a heating temperature.

5. The apparatus of either claim 1 or claim 4, wherein said vapor organic material carry pipe includes a mixing tank connected with more than at least two organic material chamber for mixing more than at least two vapor organic materials.

6. The apparatus of claim 1, wherein said spraying unit is implemented by a shower head having a plurality of spraying portions each having a small diameter, through which a vapor organic material is sprayed, or a spraying tube in which a spraying portion is formed in a pipe shape.

7. The apparatus of claim 1, wherein said furnace is formed in a certain shape selected from the shapes of polygonal, cylindrical or spherical shapes which are separated in their inner and outer sides.

8. A vapor organic material deposition method, comprising the steps of:

a first step in which a heating heater contacting with an outer surface of an organic material chamber including an organic material therein radiates heat and heats the organic material to a temperature

above an evaporation temperature;

a second step in which a vapor organic material evaporated by the heating heater is moved to a spraying unit of the deposition chamber in which a mother material on which a vapor organic material is deposited is positioned, through a vapor organic material carry pipe surrounded by a fixed temperature heater which radiates heat; and

a third step in which a vapor organic material carried to the spraying unit is sprayed in a gravity direction from an upper portion of the mother material placed in an upper portion of a mother material mounting portion and is deposited on an upper surface of the mother material.

9. The method of claim 8, wherein said spraying unit of said third step is horizontally moved in a longitudinal direction of the vapor organic material carry pipe and/or is rotated.

10. The method of either claim 8 or claim 9, wherein said mother material mounting portion of said third step is horizontally moved in a bottom surface of the organic material chamber.

11. In a vapor organic material deposition apparatus, a vapor organic material deposition apparatus of a wider area substrate, comprising:

a gas heater which is adapted to heat an inert gas by adjusting a

gas reservoir having an inert gas therein and a MFC(Mass Flow Controller);

a heater pipe wound on an outer portion of a connection pipe for maintaining a temperature;

at least one deposition source tank which stores a gas to be deposited and an organic material and heats a high temperature gas and organic material particle by a gas heater in a state that the same are diluted for thereby generating a diluted organic material in a gaseous state;

a scan head and buffer chamber which have a deposition rate adjusting unit adapted to check and adjust a movement of the diluted organic material particle;

a gate valve which is adapted to implement a gating operation for thereby opening and closing a flow of the diluted organic material particle; and

a deposition chamber which is adapted to deposit the diluted particle flown in from the deposition source tank on a wider area substrate,

wherein the gas heater heats a gas in order for the deposition source tank adjusts the amount of gas and flows a heat source into the same, and the gate valve is installed between the buffer chamber and the deposition chamber for thereby preventing a temperature increase in a wider area substrate by a heat source of the scan head and in the interior

of the deposition chamber.

12. The apparatus of claim 11, wherein said deposition source tank stores Ar, He, N2 and oxygen as a non-explosive inert gas which is stored therein.

13. The apparatus of claim 11, wherein said san head is provided more than at least one for concurrently depositing more than at least two materials.

14. The apparatus of either claim 11 or claim 12, wherein a temperature of the heater gas is maintained at 200°C – 800°C.

15. The apparatus of claim 11, wherein said buffer chamber includes a heat source disconnecting chamber and further includes an assistant furnace for recycling an organic material in such a manner that an organic material separated when the scan head is moved is re-circulated.

16. In a vapor organic material deposition method, a vapor organic material deposition method of a wider area substrate, comprising the steps of:

a first step in which an inert gas which flows from a deposition

source tank based on an adjustment of a gas reservoir which stores an inert gas therein and a MFC(Mass Flow Controller) is heated using a gas heater based on an adjustment of a gas mount, and heat source is inputted into the interior;

a step in which a temperature is maintained by a heater pipe wound on an outer portion of a connection pipe;

a step in which at least one deposition source tank in which a gas to be deposited and an organic material are stored is heated by a gas heater in a state that a high temperature gas and an organic material particle are diluted, and a diluted organic material in a gaseous state is obtained;

a step in which a flow of the diluted organic material particle is checked and adjusted, and a gating operation is performed with respect to a scan head and buffer chamber attached with a deposition rate adjusting unit and for opening and closing a flow of a diluted organic material particle;

a step in which a diluted particle flown in from the gate valve and the deposition source tank is deposited on a wider area substrate in the deposition chamber;

a step in which the gate valve is installed between the buffer chamber and the deposition chamber and a temperature increase is prevented in a wider area substrate by a head source of the scan head

and in the interior of a deposition chamber; and

a step in which an organic material which is separated when the scan head is moved in the buffer chamber is collected by an assistant furnace installed for a re-circulation of the organic material.

17. The method of claim 16, wherein said deposition source tank contains Ar, He, N2 and oxygen as a non-explosive inert gas inputted into the interior of the same.

18. The method of claim 16, wherein in a vapor organic material generated in said deposition source tank, a pressure difference is 100-10000times with respect to the interior of the deposition chamber.

19. The method of claim 16, wherein said gating step further includes a step in which more than at least two kinds of organic materials inputted into the interior of the deposition source tank are mixed.

20. The method of claim 16, wherein said gating step further includes a step in which a thickness in the interior of an organic semiconductor fabrication system is adjusted by a process time.

21. The method of either claim 16 or claim 17, wherein a temperature

of the heater gas is maintained at 200°C – 800°C.

22. In a fabrication method of an organic semiconductor apparatus, a vapor organic material deposition method of a wider area substrate, comprising the steps of:

a step(S710) in which a substrate is loaded into a deposition chamber in a deposition apparatus;

a step(S712) in which a deposition source tank is pre-heated and a high temperature gas is flown in at a temperature of 200°C – 600°C;

a step(S714) in which a high temperature gas and an organic material particle are mixed in the interior of the deposition source tank for thereby forming a mixture, and is heated for thereby generating a SGHP(Solid-Gas Heterogeneous Phase) material;

a step(S716) in which a large amount of vapor organic material SGHP are carried from the deposition source tank to the buffer chamber through the connection pipe;

a step(S718) in which the flowing amount of the vapor organic material is measured using a vapor organic material sensor in the buffer chamber, and when the flowing amount of the vapor organic material reaches at a certain set amount, the buffer gate valve is opened;

a step(S720) in which a vapor organic material is deposited based on a scan head operation;

a step(S722) in which after a set deposition time is passed, the scan head is moved; and

a step(S724) in which the buffer gate valve is closed, and the substrate is unloaded.

FIG. 1

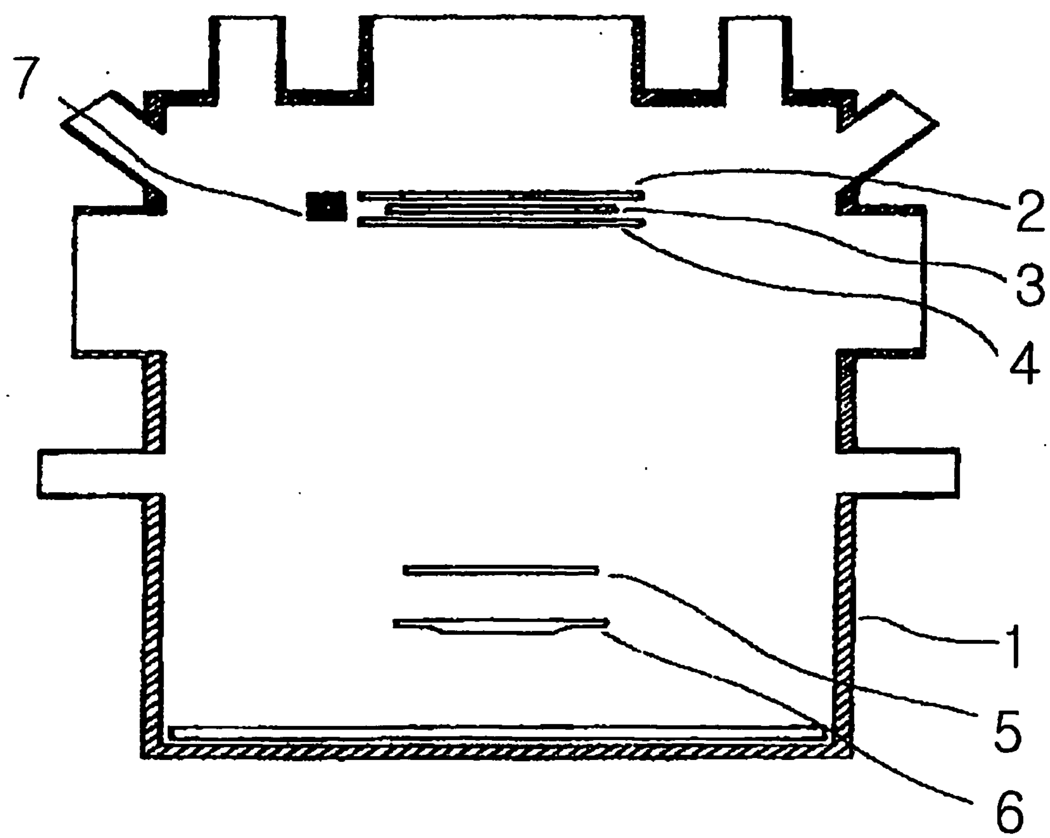

FIG. 2A

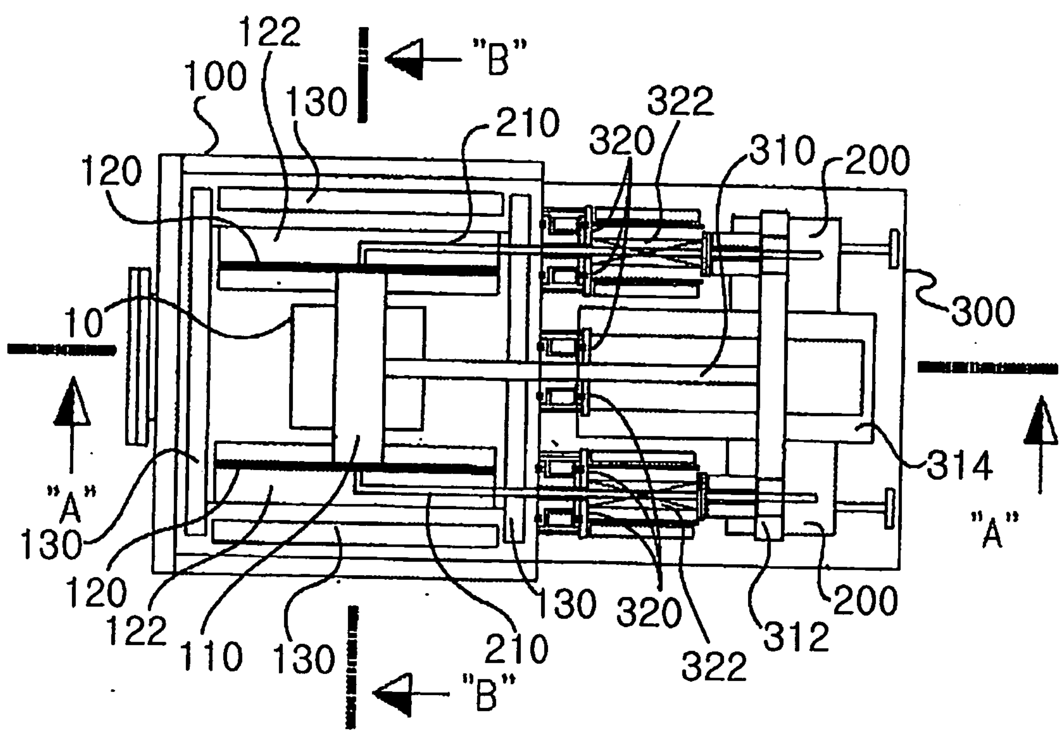
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FIG. 2B

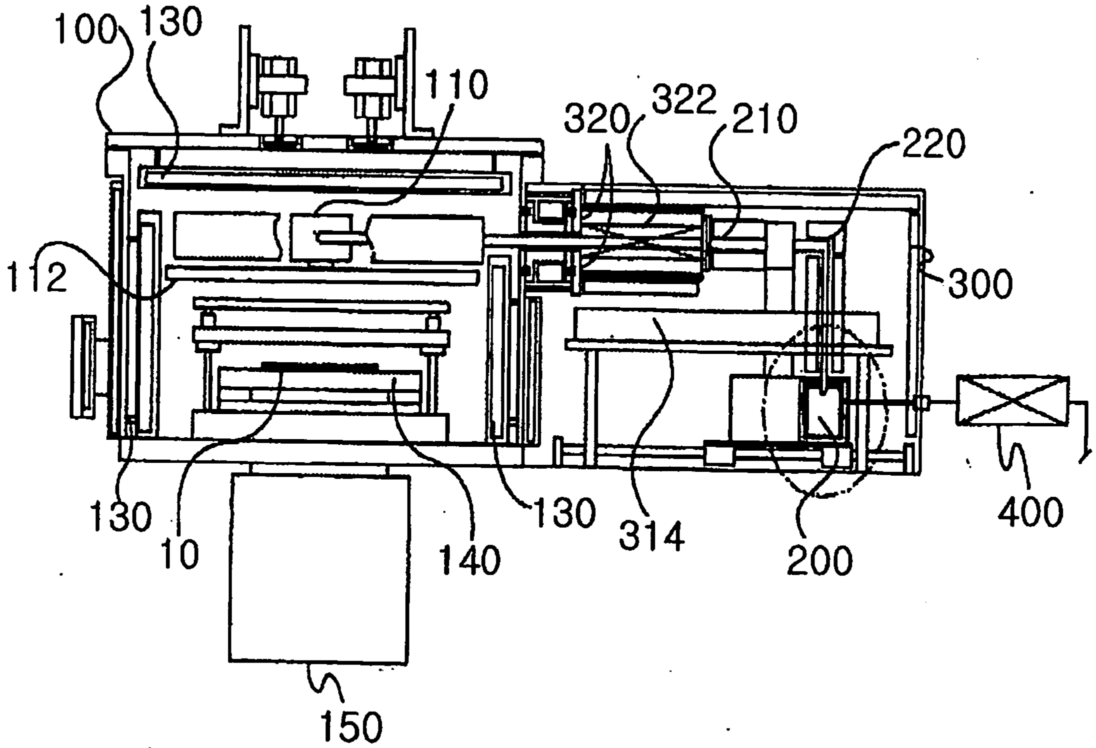
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FIG. 2C

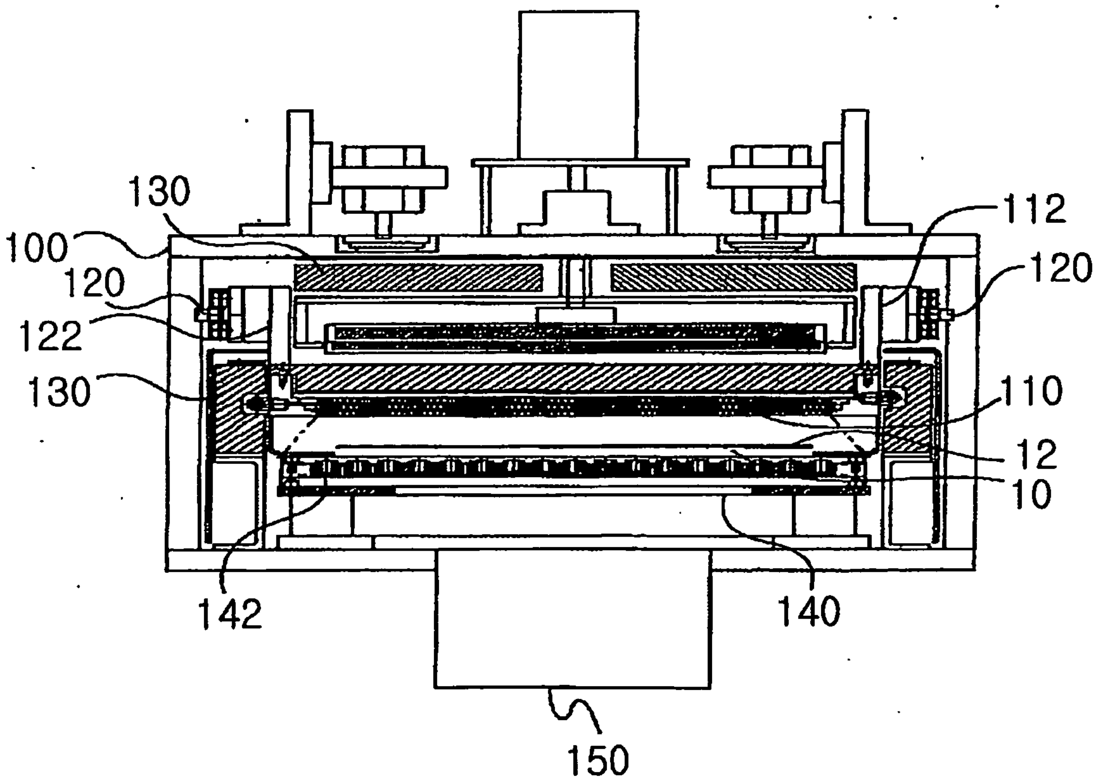


FIG. 2D

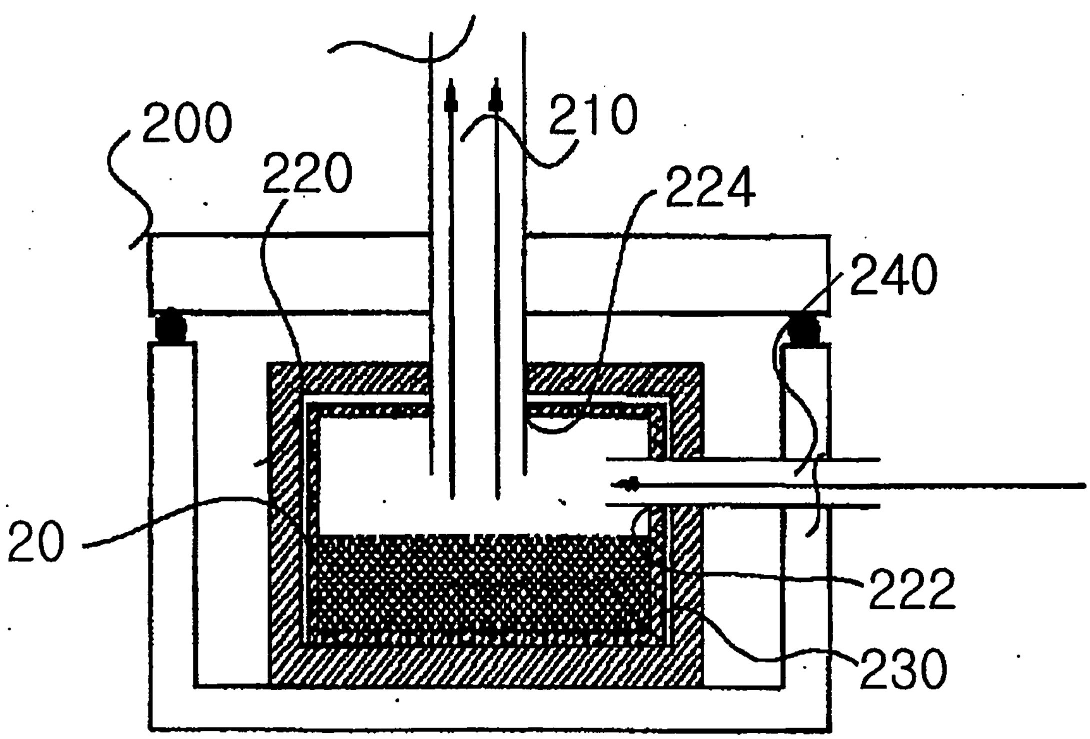


FIG. 3A

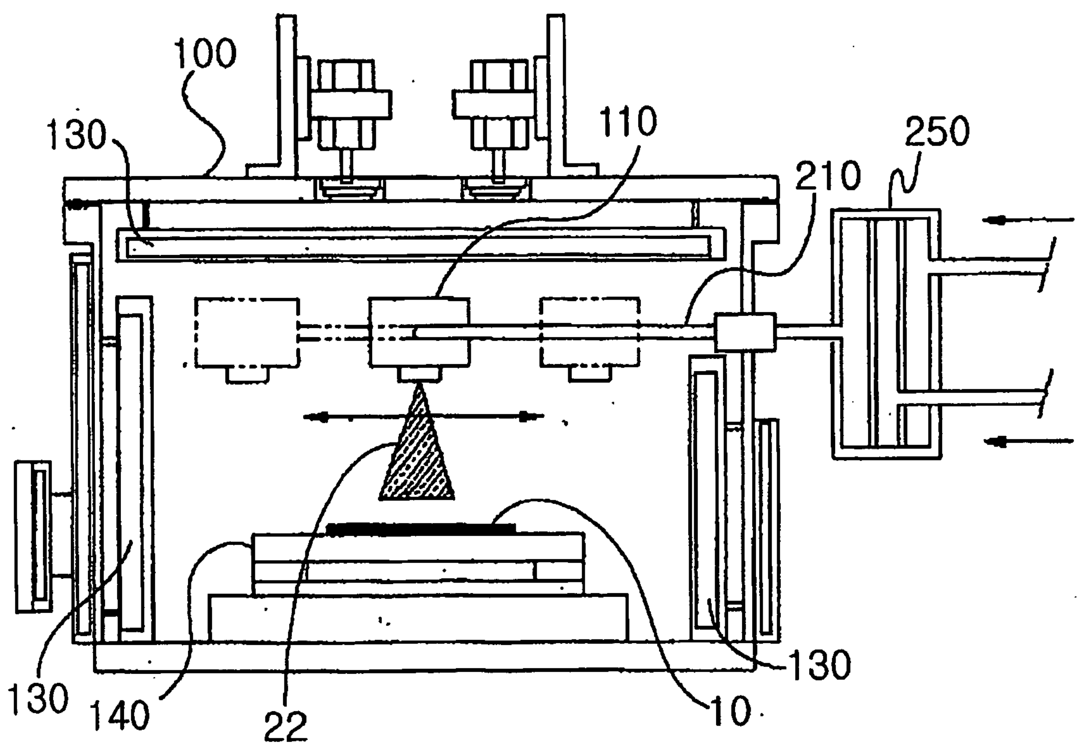


FIG. 3B

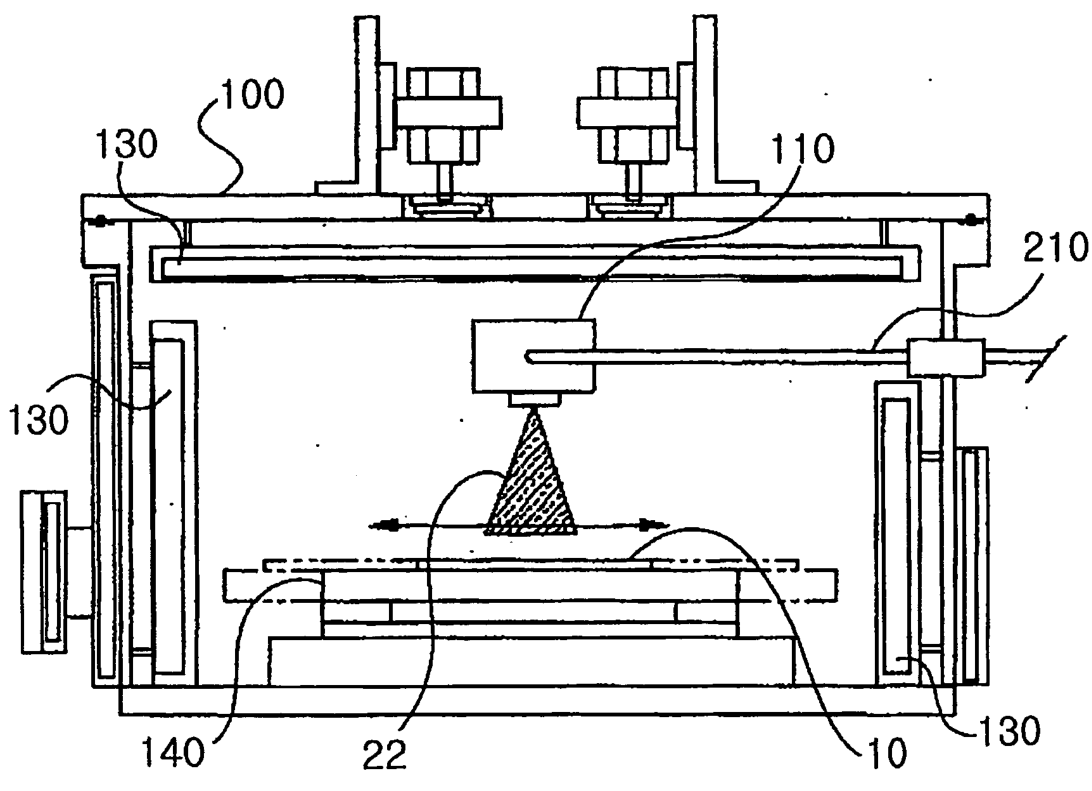


FIG. 3C

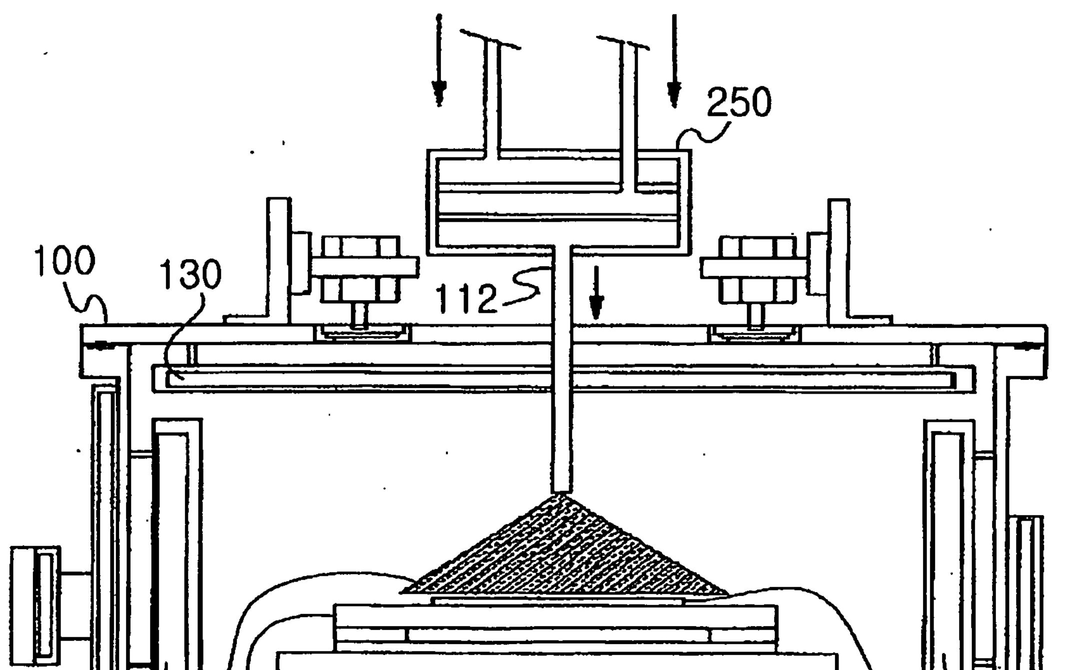


FIG. 3D

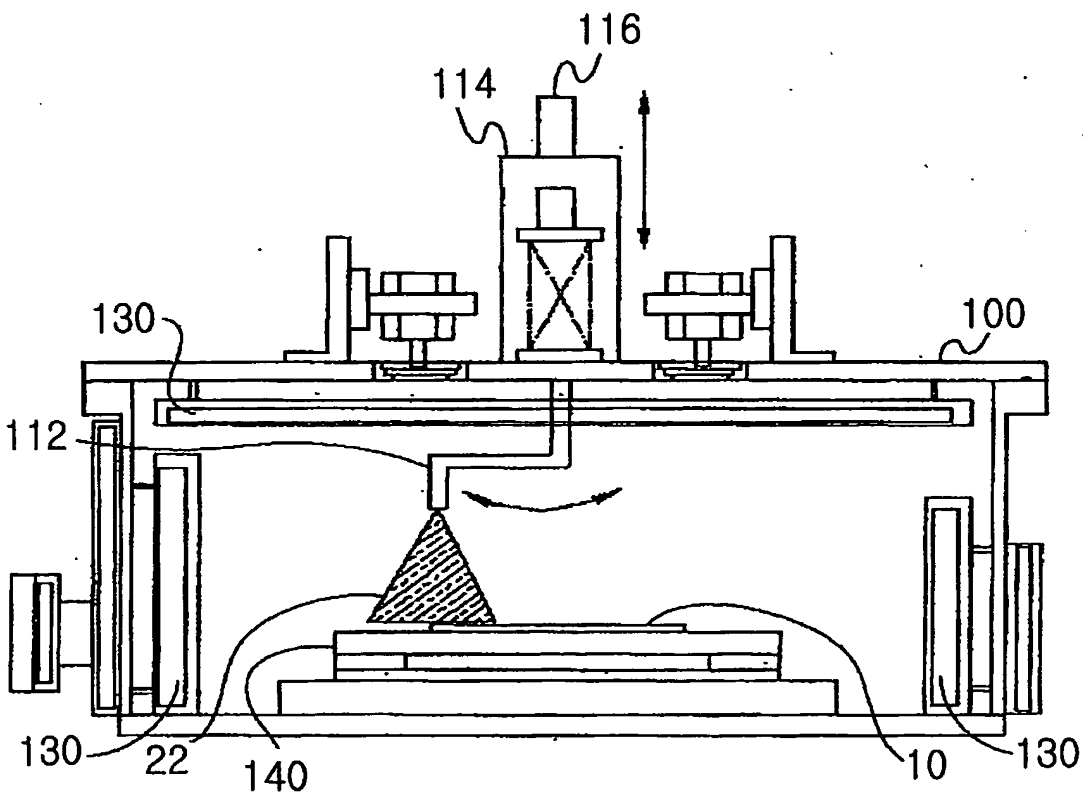


FIG. 4A

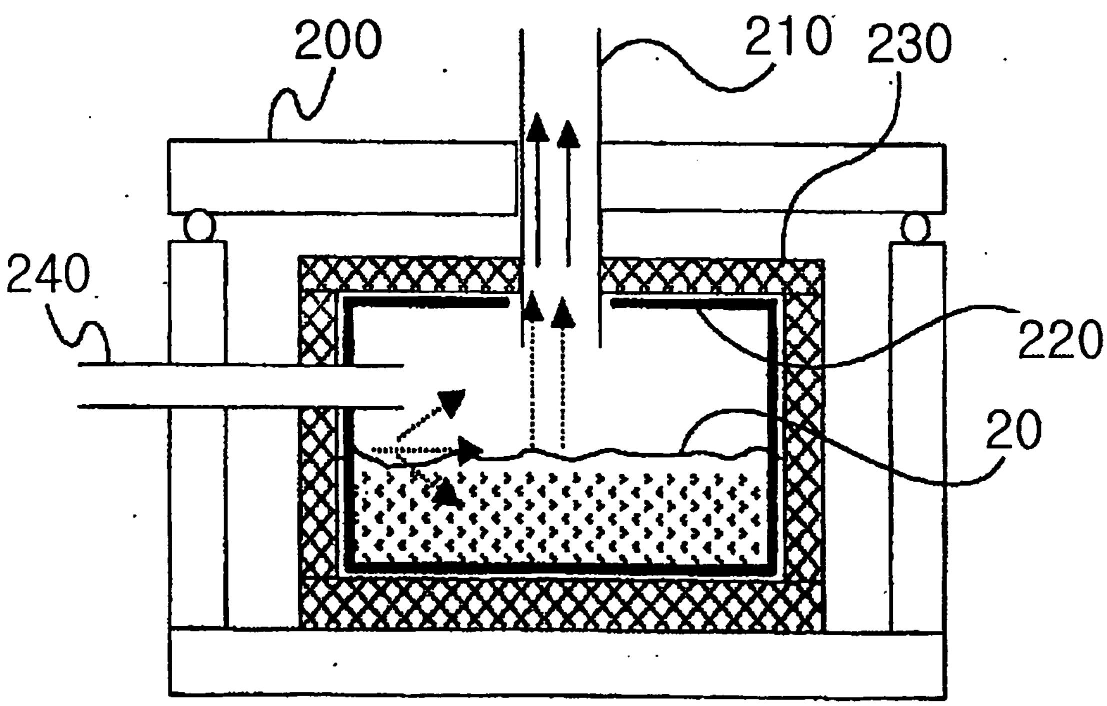


FIG. 4B

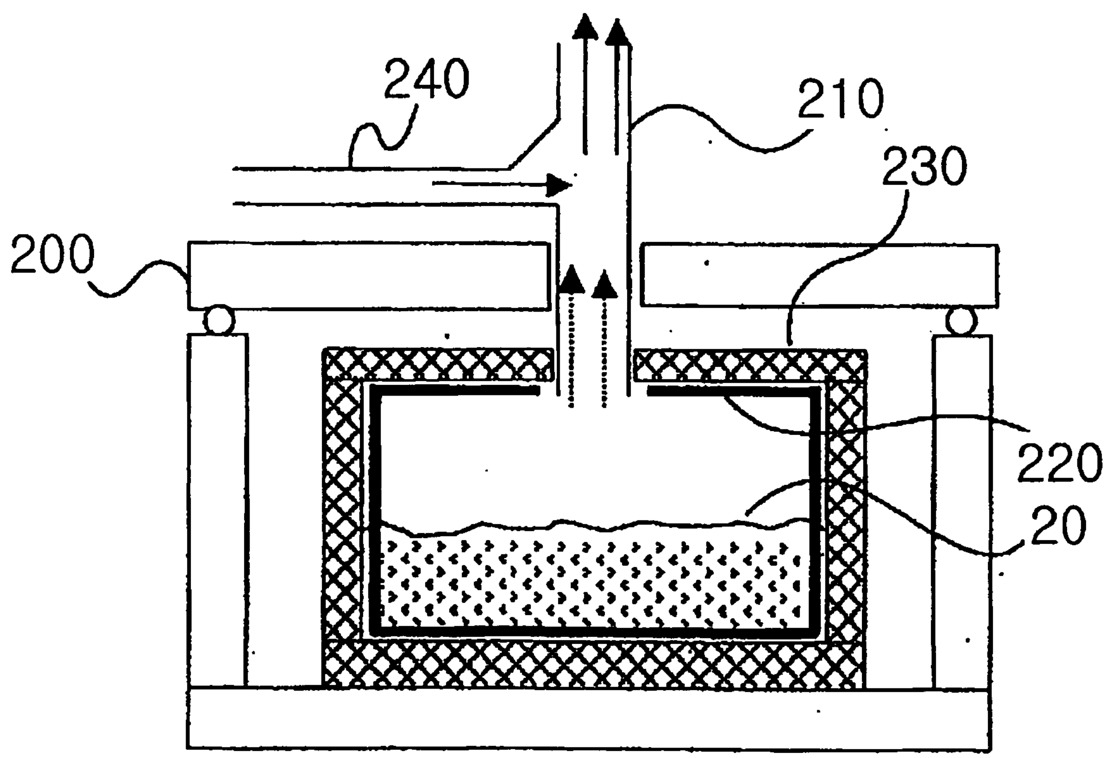


FIG. 5A

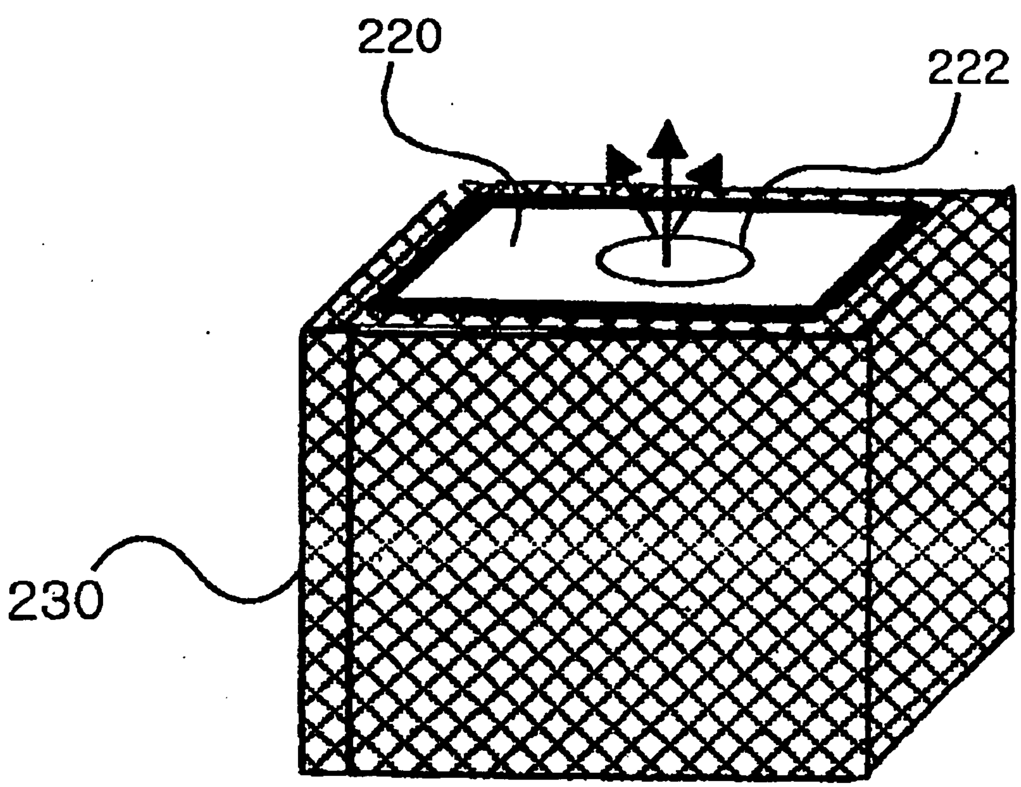


FIG. 5B

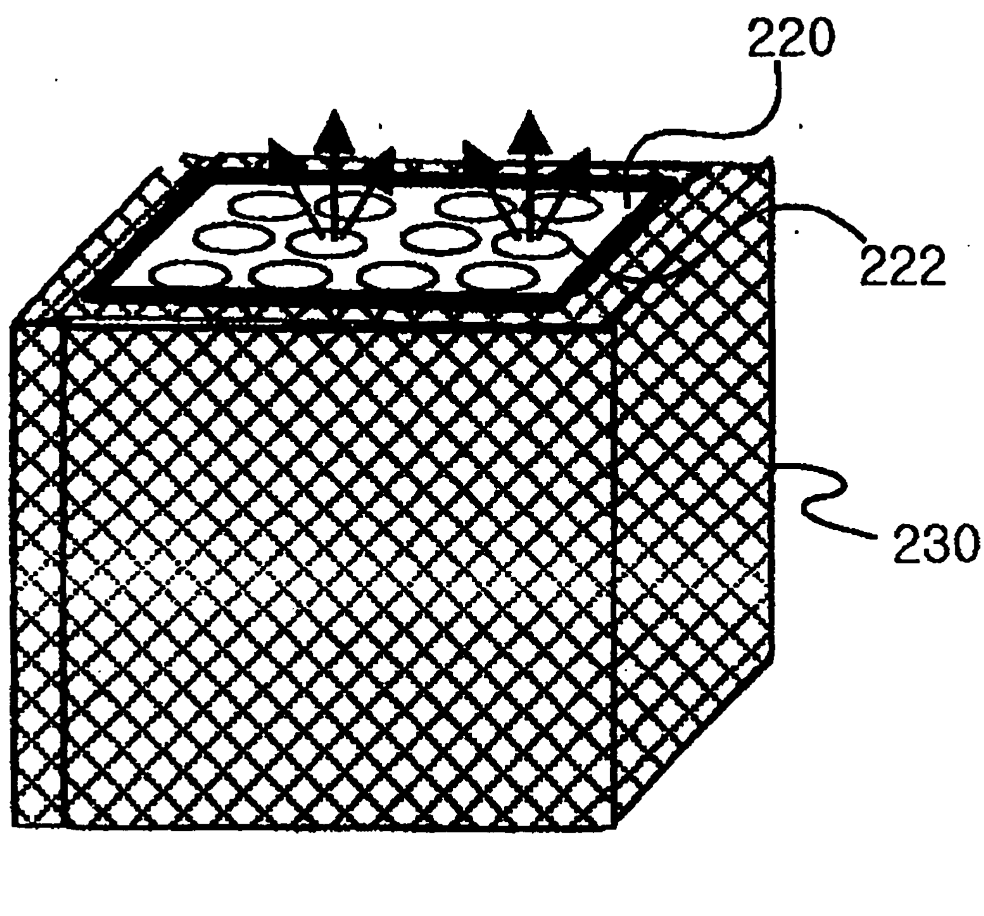


FIG. 5C

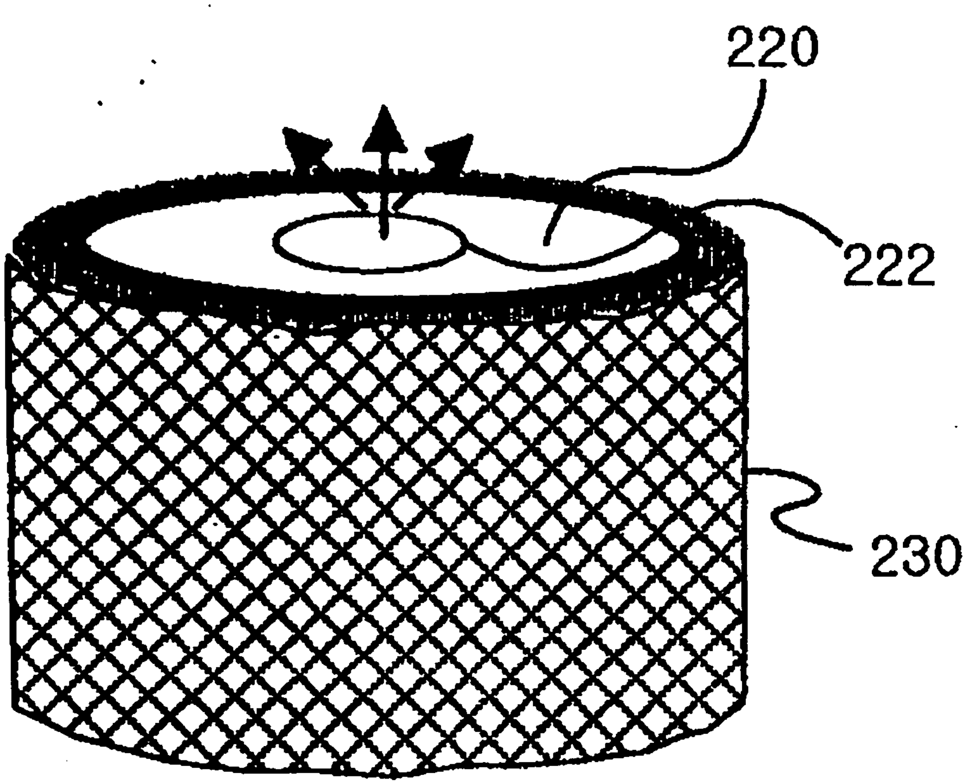


FIG. 5D

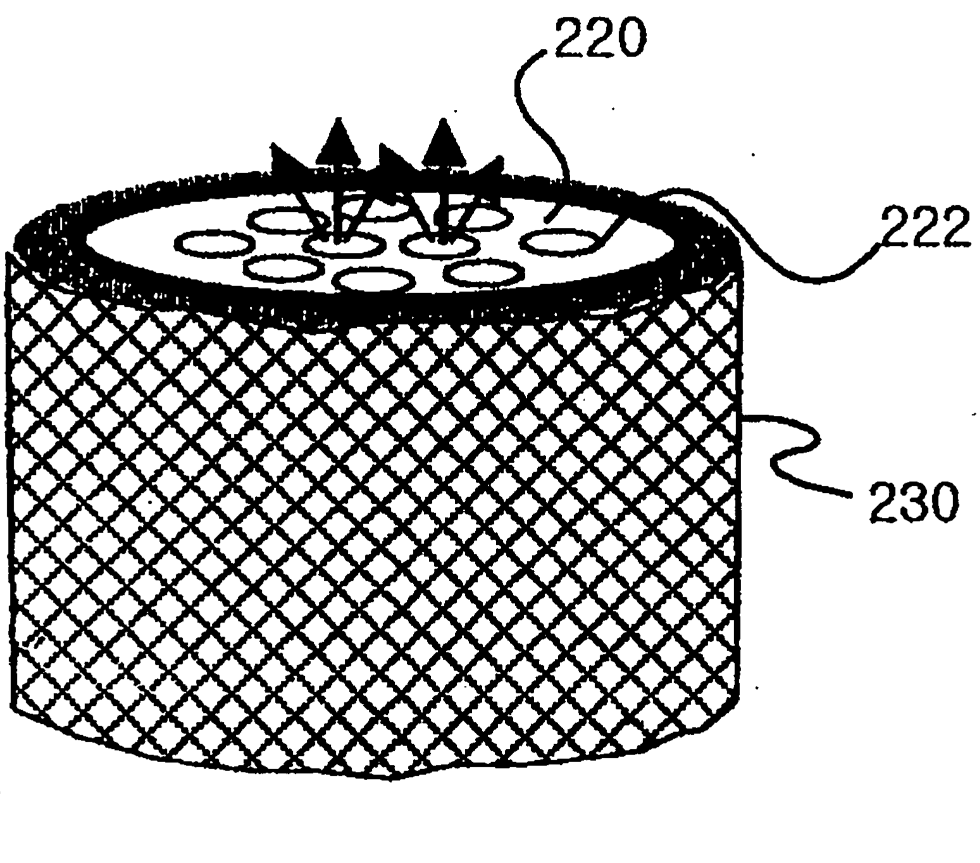


FIG. 6

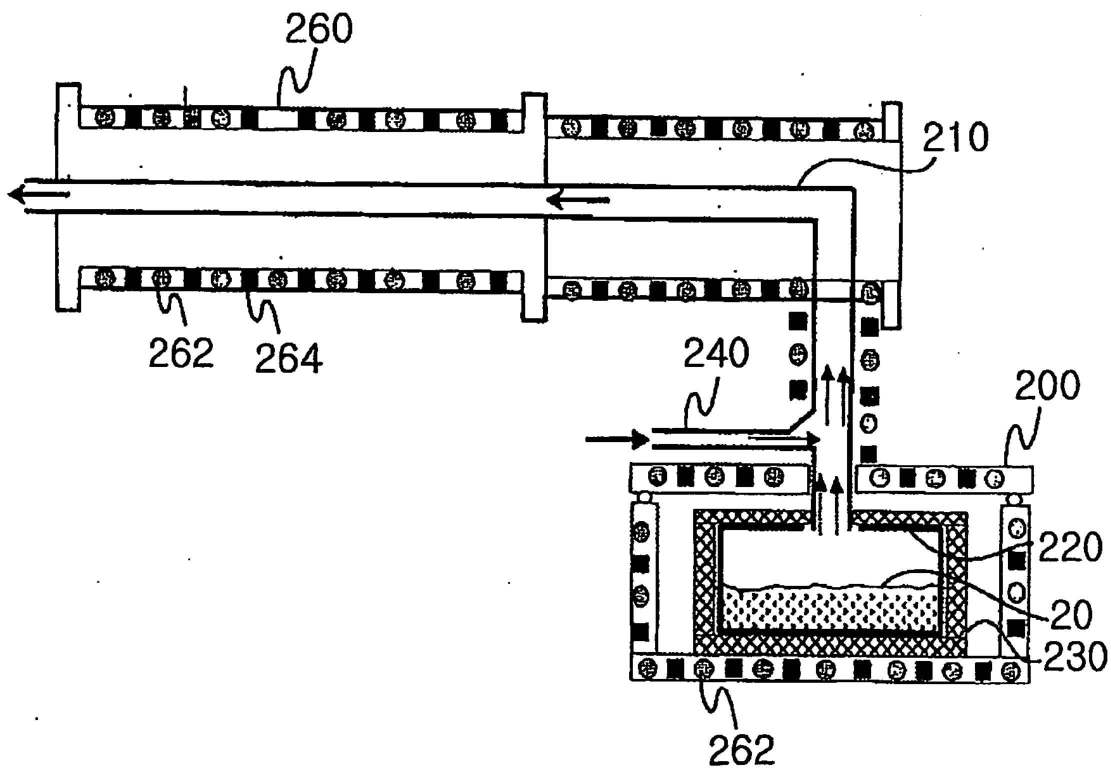


FIG. 7

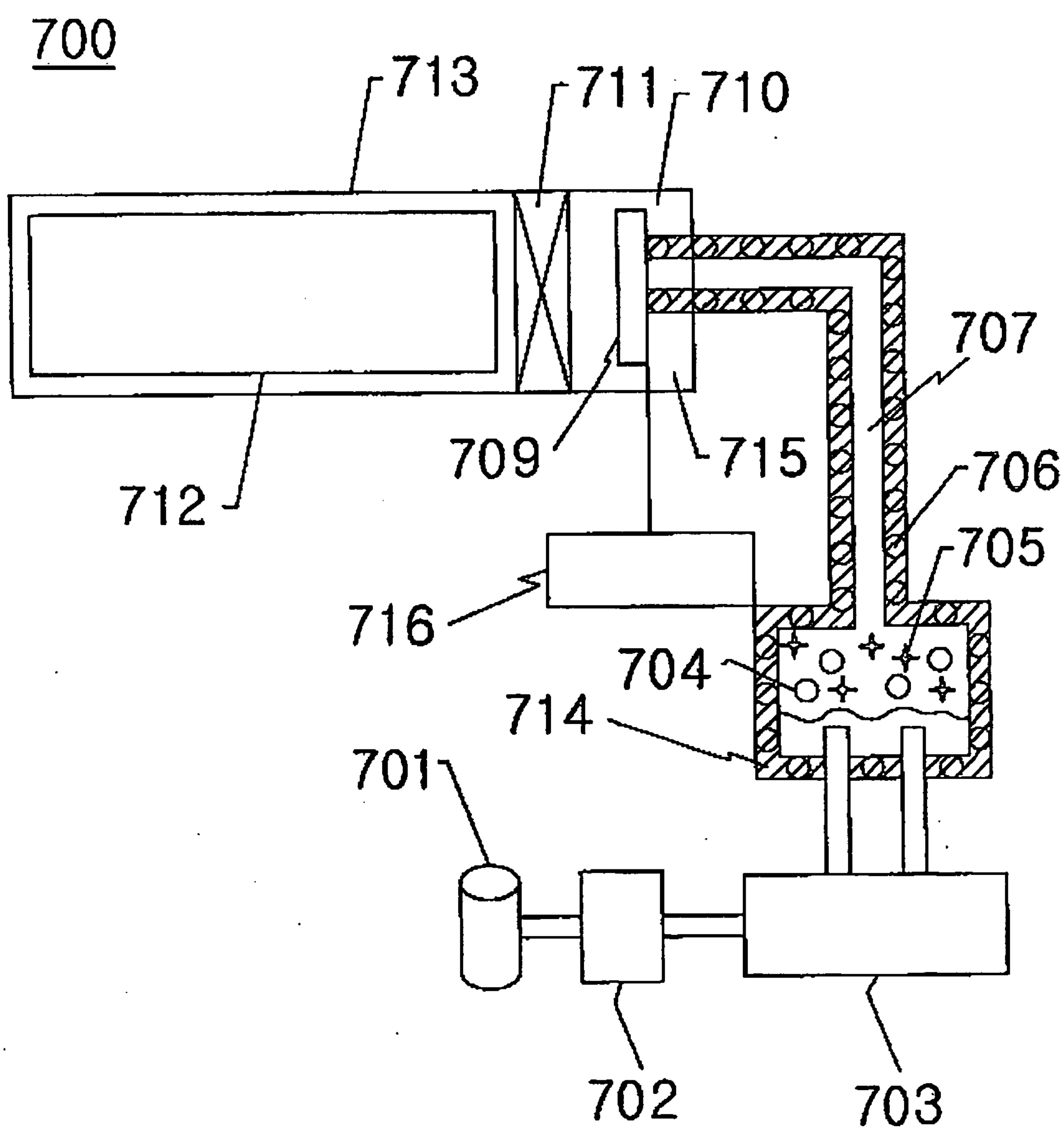


FIG. 8

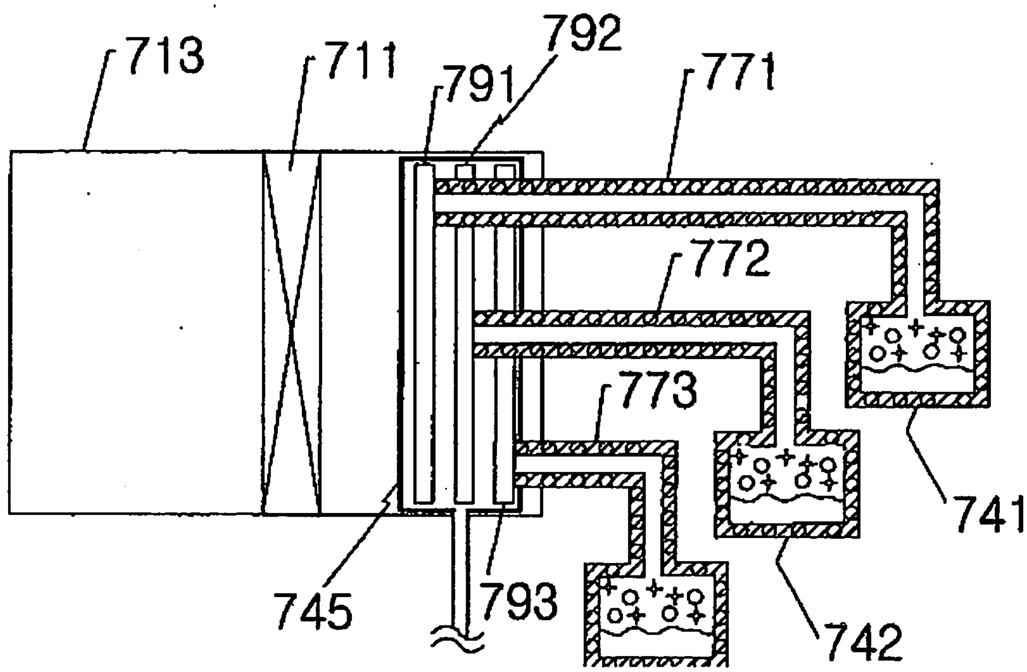


FIG. 9

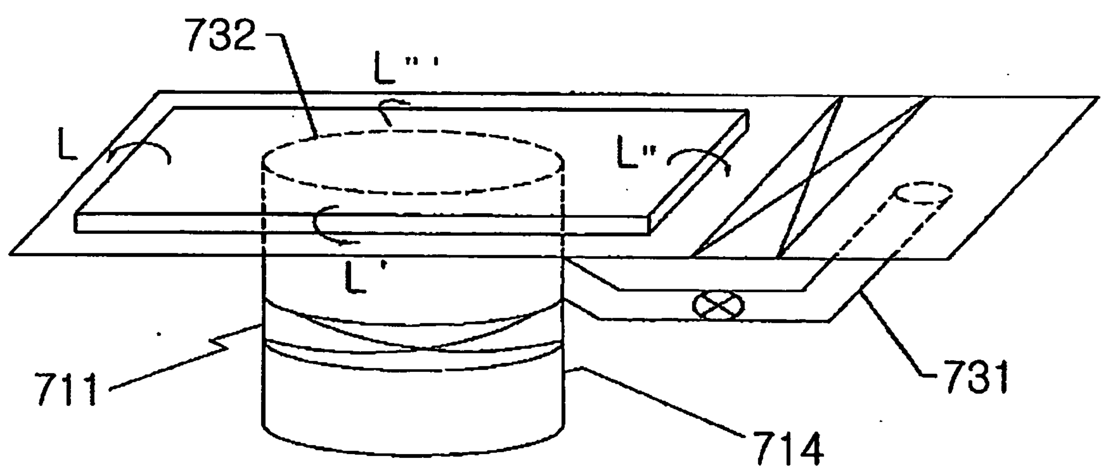


FIG. 10

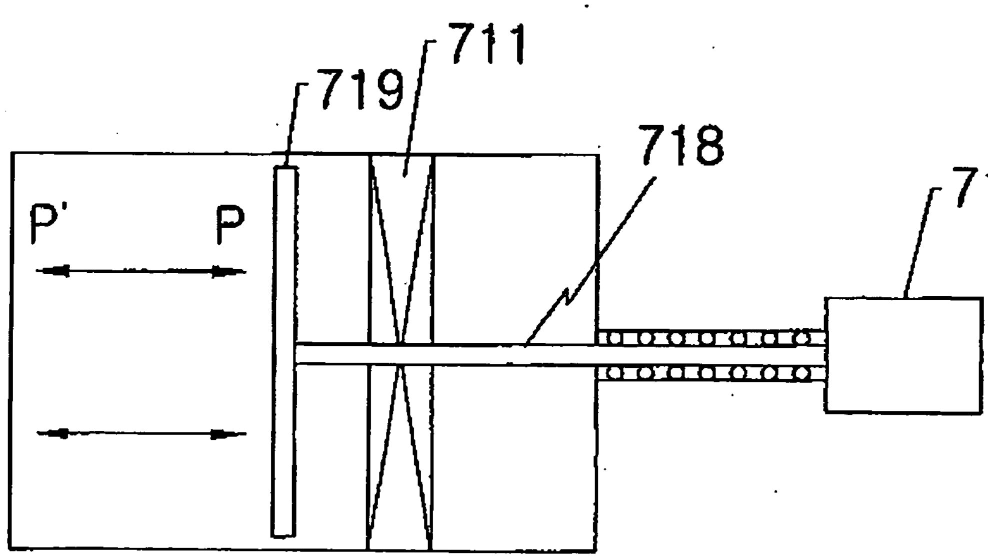


FIG. 11

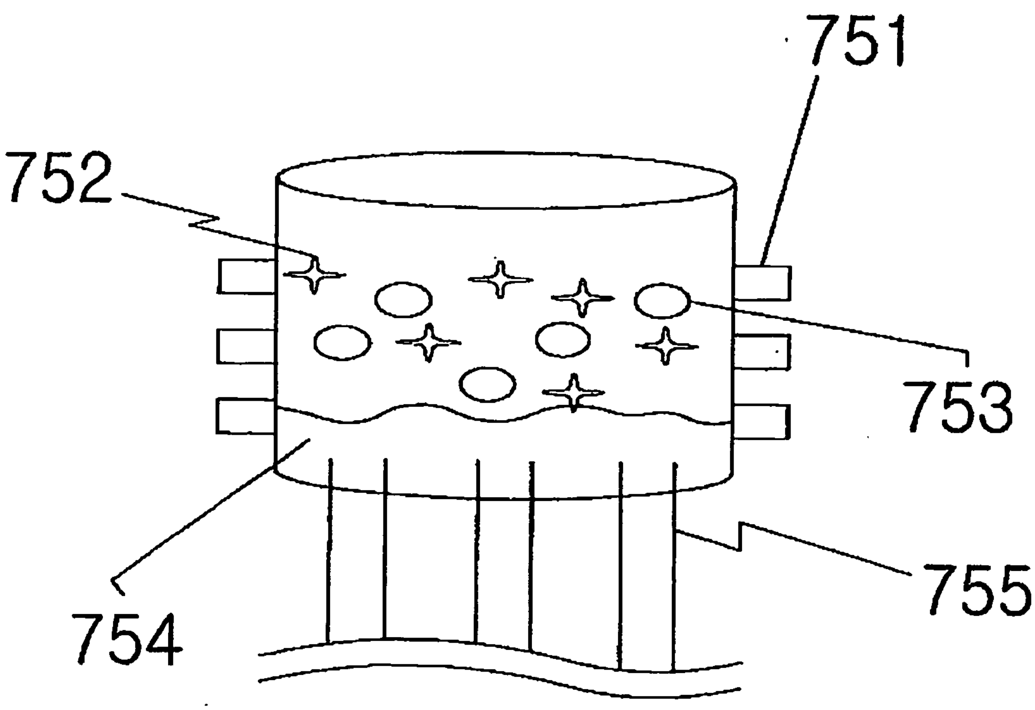


FIG. 12

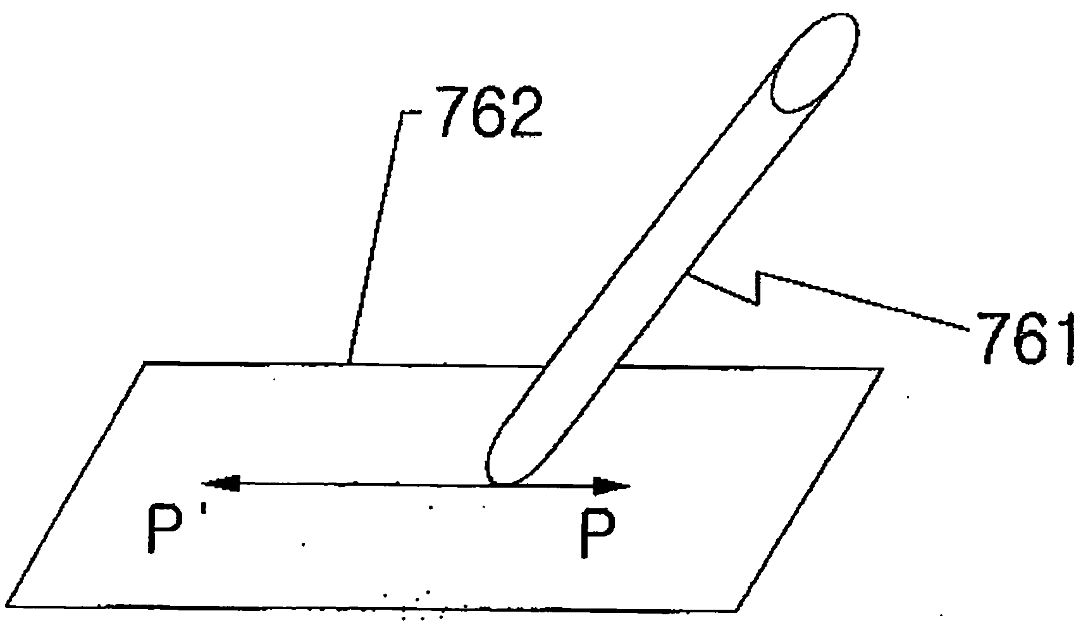


FIG. 13

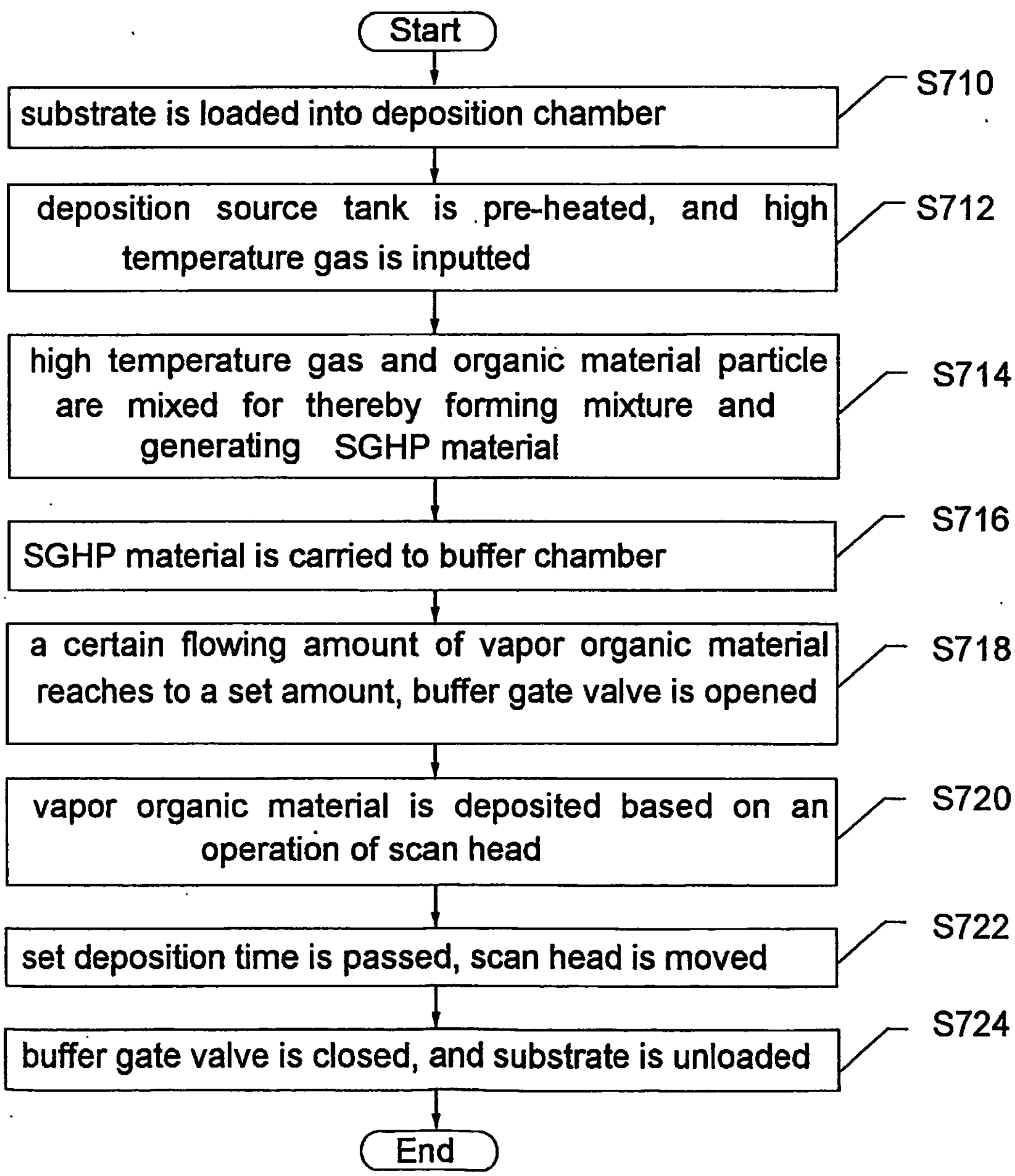
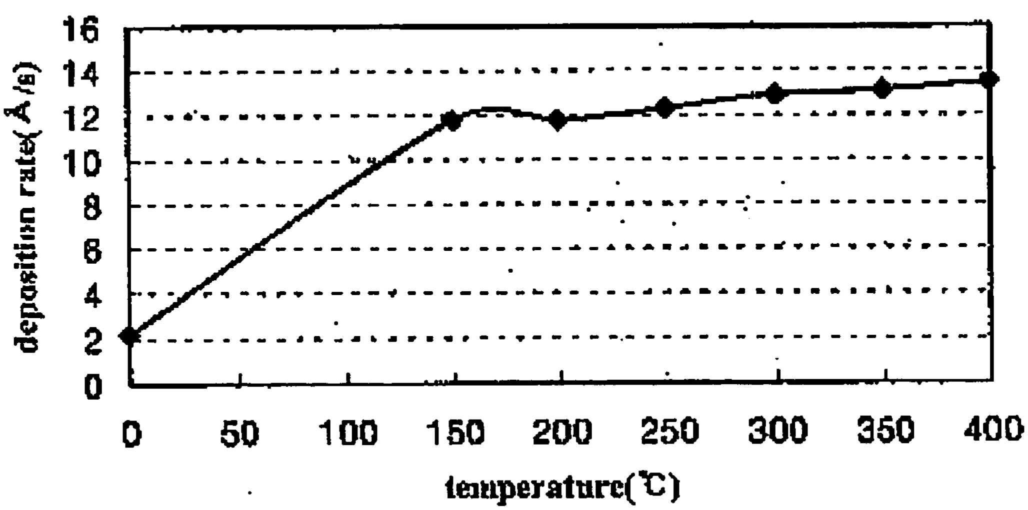

Start
substrate is loaded into deposition chamber
S710
deposition source tank is pre-heated, and high temperature gas is inputted
S712
high temperature gas and organic material particle are mixed for thereby forming mixture and generating SGHP material
S714
SGHP material is carried to buffer chamber
S716
a certain flowing amount of vapor organic material reaches to a set amount, buffer gate valve is opened
S718
vapor organic material is deposited based on an operation of scan head
S720
set deposition time is passed, scan head is moved
S722
buffer gate valve is closed, and substrate is unloaded
S724
End

FIG. 14



16
14
12
10
8
6
4
2
0
deposition rate(Å/s)
0
50
100
150
200
250
300
350
400
temperature(℃)

FIG. 15

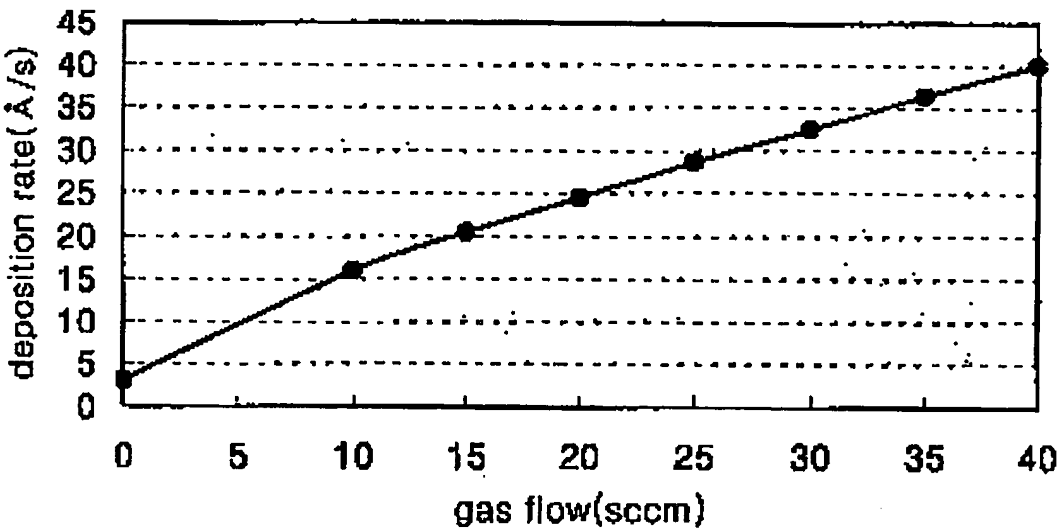
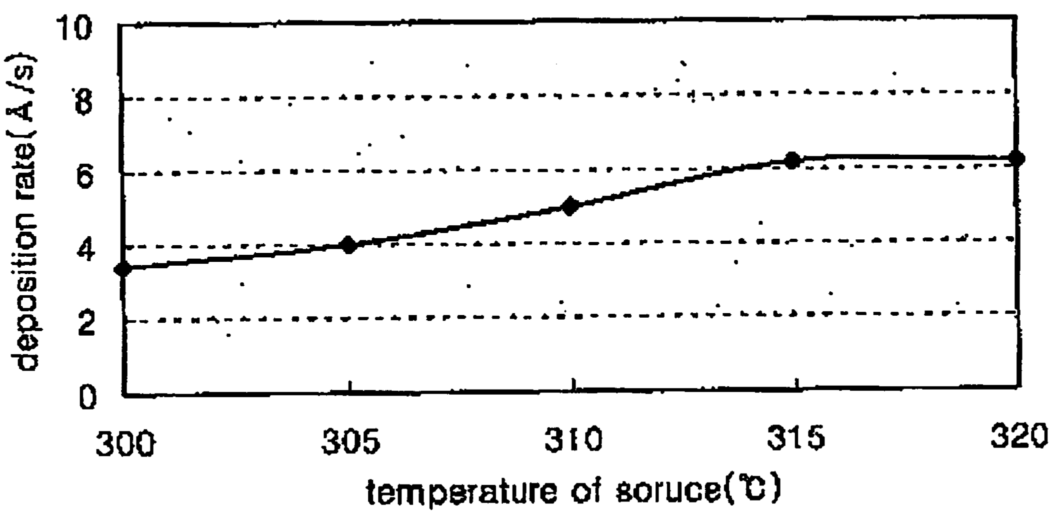

45
40
35
30
25
20
15
10
5
0
deposition rate(Å /s)
0
5
10
15
20
25
30
35
40
gas flow(sccm)

FIG. 16


10
8
6
4
2
0
deposition rate(Å /s)
300
305
310
315
320
temperature of soruce(℃)

INTERNATIONAL SEARCH REPORT

International application No. PCT/KR03/00605

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 C23C 16/44

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 C23C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9708356 (UNIV. CALIFORNIA) 06 March 1997 Abstract and Claims.	1-21
A	JP 07243025 (KOBESTEEL LTD.) 19 September 1995 Claim1	1-21
A	EP 1167566 (MATSUSHITA ELECTRIC WORKS LTD.) 02 January 2002 Abstract and Claims.	1-21
A	JP 04980204 (FUJITSU LTD.) 25 DECIMBER 1990 Claims	22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 JUNE 2003 (09.06.2003)	09 JUNE 2003 (09.06.2003)

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